DRAFT REMOVAL ACTION COMPLETION REPORT
SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

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614 Magnolia Avenue

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List of Acronyms and Abbreviations

2H:1V	2 horizontal to 1 vertical
Administrative Area	16901 Market Street, Channelview, Texas
Anchor QEA	Anchor QEA, LLC
AOC	Administrative Order on Consent
ATV	all-terrain vehicle
Big Star	Big Star Barge & Boat Company, Inc.
BMP	Best Management Practice
CAC	Community Awareness Committee
CAT	Caterpillar
CCRB	crushed concrete road base
cfs	cubic feet per second
CHASP	Contractor Health and Safety Plan
CO	change order
CQAO	Construction Quality Assurance Officer
CQAP	Construction Quality Assurance Plan
CQC	Construction Quality Control
CRA	Chris Ransome & Associates
CRZ	Contamination Reduction Zone
CTB	concrete traffic barrier
CWP	Construction Work Plan
Envirocon	Envirocon Systems, Inc.
EPP	Environmental Protection Plan
GPS	global positioning system
H&S	Health and Safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Health and Safety Officer
I-10	Interstate Highway 10
IPC	International Paper Company
LaBarge	LaBarge Realty, LLC
LLDPE	linear low-density polyethylene
MHHW	mean higher high water
MHW	mean high water

MIMC	McGinnes Industrial Maintenance Corporation
MLLW	mean lower low water
MLW	mean low water
MSL	mean sea level
MTL	mean tide level
National Fence	National Fence Company
NAVD88	North American Vertical Datum of 1988
ng/kg	nanograms per kilogram
NOAA	National Oceanic and Atmospheric Administration
OC	organic carbon
OMM	operations, monitoring, and maintenance
oz	ounce
PPE	Personal Protective Equipment
QA/QC	quality assurance/quality control
RACR	removal action completion report
RAWP	removal action work plan
RDF	recycling and disposal facility
RFI	Request for Information
RI/FS	Remedial Investigation/Feasibility Study
River	San Jacinto River
ROW	right-of-way
Shirley and Sons	Shirley & Sons Construction Company, Inc.
SJRWP	San Jacinto River Waste Pits
SOW	Statement of Work
SSP	Site Security Plan
START	Superfund Technical Assessment & Response Team
TCDD	tetrachlorodibenzo-p-dioxin
TCEQ	Texas Commission on Environmental Quality
TCLP	toxicity characteristic leachate procedure
TCRA	time critical removal action
TCRA Site	San Jacinto River Waste Pits Superfund Site
TDSHS	Texas Department of State Health Services
TMDL	Total Maximum Daily Load
TOPCON	TOPCON Positioning Systems, Inc.
TPH	total petroleum hydrocarbon

TSF	tons per square foot
TxDOT	Texas Department of Transportation
UAO	Unilateral Administrative Order
USA	USA Environment, LP
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WDC	Work Directive Change
WQMP	Water Quality Monitoring Plan

1 INTRODUCTION

This document presents the Removal Action Completion Report (RACR) describing the time critical removal action (TCRA) implemented at the San Jacinto River Waste Pits (SJRWP) Superfund Site (Site) (USEPA Identification Number: TXN000606611) in Harris County, Texas (Figure 1-1). The TCRA was implemented by International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC) under an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) - Docket No. 06-12-10, May 2010 (USEPA 2010a).

As required by Task 5 of the Statement of Work (SOW) for the AOC, this RACR presents a final engineering design and implementation summary for the TCRA; outlines the construction timeline, performance standards, inspections, certifications, and costs; and includes a final summary of lessons learned. This RACR is also the final report referenced in Paragraph 50 of the AOC. The RACR includes the following major sections:

- Section 1 describes the Site physical conditions, operational history of the waste impoundments that were the subject of the TCRA (SJRWP), and previous investigations.
- Section 2 outlines both the AOC and the TCRA objectives; it also summarizes the basis for the TCRA design, along with the approved modifications to the Removal Action Work Plan (RAWP).
- Section 3 describes the community awareness activities initiated throughout the TCRA process.
- Section 4 describes the TCRA land-based construction activities, including mobilization/demobilization, health and safety, site security, and final survey.
- Section 5 describes the TCRA water-based construction activities, including mobilization/demobilization, health and safety, water quality monitoring, and progress and final surveys.
- Section 6 presents a chronology of significant construction events.
- Section 7 describes the performance standards and construction quality control.
- Section 8 describes the final inspections and certifications for TCRA construction, health and safety, and institutional and engineering controls.
- Section 9 outlines post-construction operation and maintenance activities.

- Section 10 provides an estimate of TCRA construction costs.
- Section 11 outlines the lessons learned during the TCRA construction.
- Section 12 provides contact information for individuals involved in the TCRA.
- Section 13 provides the TCRA certification requirements for completion.
- Section 14 provides a list of references.
- Appendices include the following:
  - Appendix A USEPA Action Memorandum
  - Appendix B License Agreement with the Texas Department of Transportation (TxDOT)
  - Appendix C TCRA Daily and Weekly Progress Reports
  - Appendix D TCRA Progress Photographs
  - Appendix E USA Environment Requests for Information (RFIs)
  - Appendix F Above-Ground Vegetation Memorandum
  - Appendix G Western Cell Revised Approach Memorandum
  - Appendix H Geomembrane Layout
  - Appendix I LaBarge Property Pre-Construction Sampling Results
  - Appendix J Water Quality Monitoring Memorandum
  - Appendix K Non-Hazardous Waste Manifests
  - Appendix L Material and Analytical Testing Reports
  - Appendix M Operations, Monitoring, and Maintenance Plan

1.1 Site Location

The SJRWP (TCRA Site) consists of a set of impoundments approximately 15.7-acres in size, built in the mid-1960s for disposal of paper mill wastes. The impoundments are located on a 20-acre parcel on the western bank of the San Jacinto River, in Harris County, Texas, immediately north of the Interstate Highway 10 (I-10) Bridge over the San Jacinto River (Figure 1-2). The Site, as defined by USEPA, also includes the surrounding areas containing sediments and soils potentially contaminated with the impoundment waste materials. The coordinates for the TCRA Site's location are: 29.7944° N (Latitude), 95.0629° W (Longitude).

For purposes of the TCRA design, the TCRA Site was subdivided into the following areas:

- Eastern Cell

- Western Cell
- Northwestern Area

The location of each of these areas is depicted on Figure 1-2. The pre-TCRA physical conditions associated with each area are discussed below.

1.2 Environmental Setting

The TCRA Site is within the estuarine portion of the lower San Jacinto River. This section provides a regional overview of the watershed characteristics of the San Jacinto River and the Texas Gulf Coast and Houston-area climate. Site-specific information regarding the hydrodynamic conditions and the pre-TCRA Site physical conditions (Figure 1-3) are also discussed.

1.2.1 Watershed Characteristics and Galveston Bay Ecosystem

The San Jacinto River drains an area of 3,900 square miles and supplies approximately 28 percent of the fresh water entering Galveston Bay (Gardiner et al. 2008). The main channel of the San Jacinto River, downstream from the Lake Houston dam in northeastern Harris County, flows southeast for 28 miles to its mouth on Galveston Bay east of Houston. The 9-mile-long Lake Houston and the River below it are formed by the confluence of the 69-mile-long East Fork and the 90-mile-long West Fork of the San Jacinto River. The dam that forms Lake Houston is an earthfill dam that is 62 feet high with a concrete spillway. The reservoir that is created by the dam is used for recreation, as well as an industrial, municipal, and agricultural water supply.

The Houston Ship Channel, which was created in 1914, was dredged to widen the lower San Jacinto River (dredging did not extend as far upstream as the Site) to link the Port of Houston with Galveston Bay and the Gulf of Mexico. It is likely that construction of the Houston Ship Channel directly altered surface water circulation by providing a larger cross-section for north to south water movement on the main axis of the bay and by breaching Redfish Bar, which had previously limited water exchange between the upper and lower bay (Lester and Gonzalez 2005).

1.2.2 Site Hydrodynamic Conditions

Flow rates in the San Jacinto River in the vicinity of the Site are partially controlled by the Lake Houston dam, which is located about 9.5 miles northwest of the waste impoundments. The average flow in the River is 2,200 cubic feet per second (cfs). Floods in the River primarily occur during tropical storms (e.g., hurricanes) or intense thunderstorms. Extreme flood events (return intervals of 25-years or more) have flow rates of 200,000 cfs or greater. An October 1994 flood had a peak discharge of 360,000 cfs, which has a return period of greater than 100-years. River stage height during the October 1994 flood had a maximum value of 27 feet above mean sea level (MSL).

The River in the vicinity of the waste impoundments is affected by diurnal tides, with a typical tidal range of 1 to 2 feet. Tidal range varies over a 14-day cycle, with neap and spring tide conditions corresponding to minimum and maximum tidal ranges, respectively. Tropical storms and wind storms from the north can have significant effects on water levels at the Site. Tropical storms can cause storm surges with water levels that are significantly higher than typical tidal elevations. Storms with strong winds from the north can cause water to be transported out of the Galveston Bay system, which can result in water levels that are much lower than low tide elevations. Table 1-1 presents a summary of the tidal elevations at the gauge that was historically nearest the Site for the 1983 to 2001 tidal epoch, relative to the project vertical datum NAVD 88.

Table 1-1

Tidal Relationships for Battleship Texas State Park Gauge

Datum	Elevation (feet)
NAVD 88	0.0
Mean Lower Low Water (MLLW)	0.05
Mean Low Water (MLW)	0.22
Mean Tide Level (MTL)	0.83
Mean Sea Level (MSL)	0.86
Mean High Water (MHW)	1.43
Mean Higher High Water (MHHW)	1.52

Note: Primary benchmark 0743 A 2002 at elevation 11.54 feet NAVD 88.

Salinity in the vicinity of the waste impoundments generally ranges between 10 and 20 parts per thousand during low to moderate flow conditions in the River. During floods, salinity values approach freshwater conditions.

1.2.3 Climate

The climate along the Gulf Coast of Texas and the area surrounding Houston is humid subtropical. The average annual precipitation is 54 inches, the warmest month is July, with an average temperature of 85°F, and the coldest month is January, with an average temperature of 54°F. Prevailing wind directions for the region are primarily from the south or southeast. During the spring season, large thunderstorms are common and are capable of producing tornados; with the transition to the summer months with the mild temperatures noted above, the relative humidity can reach upwards of 90 percent and results in a heat index much higher.

Monthly rainfall data over a 10-year period (1999-2009) was tabulated and the average monthly precipitation is shown in Figure 1-4. The monthly average precipitation varies from approximately 2.5 inches in February to over 7 inches in June. The figure shows that from a high in June, average monthly rainfall drops until October, where there is another abrupt increase, followed by another decline. This decline leads into the winter months before reversing in late winter into early spring, where monthly average values once again increase, until reaching their peak in June.

It is not uncommon to have precipitation events that exceed 2 inches per day, and on a 10-year basis, events that exceed 10 inches per day should be expected. These types of precipitation events produce wide variations in the volume of discharge into and out of the San Jacinto River and have significant implications concerning variations in flow velocities, sediment stability, and suspended sediment loads.

Tropical weather systems can have significant impacts on regional precipitation and hydrology along the Gulf Coast. Hurricane season runs from June 1 to November 30. Between 1851 and 2004, 25 hurricanes have made landfall along the north Texas Gulf Coast, seven of which were major (Category 3 to 5) storms (NOAA 2005). Tropical Storm Allison, which hit the Texas Gulf Coast June 5 through 9, 2001, resulted in 5-day and 24-hour rainfall totals of 20 and 13 inches respectively, in the Houston area, resulting in significant flooding. More recently, Hurricane Rita made landfall on September 23, 2005, between Sabine Pass, Texas, and Johnsons Bayou, Louisiana, as a Category 3 on the Saffir-Simpson Hurricane Scale with winds at 115 mph. The storm surge caused extensive damage along the Louisiana and extreme southeastern Texas coasts. On September 13, 2008, the eye of Hurricane Ike made landfall at the east end of Galveston Island and traveled north up Galveston Bay, along the east side of Houston. Ike made its landfall as a strong Category 2 hurricane, with Category 5 equivalent storm surge, and hurricane-force winds that extended 120 miles from the storm's center.

1.2.4 Pre-TCRA Physical and Chemical Conditions in the Eastern Cell

The Eastern Cell is generally characterized by shallow water. Prior to TCRA construction, bed elevations ranged from -10 to 0 feet NAVD 88; on the west side of the Eastern Cell, an earthen berm (known as the central berm) extended up to elevations as high as 8 feet NAVD 88.

Source material in the Eastern Cell consisted of clay varying from low to high plasticity, with 60 to 90 percent fines, and water content that ranged from 69 to 147 percent. Subsurface conditions at the Site are described in more detail in Appendix J of the RAWP (Anchor QEA 2010a, as amended 2011), and consisted of the soft surface source material (silt and clay) overlying sand, which overlies a hard clay formation.

Surface sampling in the Eastern Cell identified concentrations of 2,3,7,8-TCDD that range from 5.43 to 9,720 nanograms per kilogram (ng/kg) dry weight basis or 986 to 360,000 ng/kg OC-normalized basis. Based on six pre-construction samples, the average concentration of surface samples in the Eastern Cell was 1,945 ng/kg dry weight, 87,596 ng/kg OC-normalized (Figure 1-3).

1.2.5 Pre-TCRA Physical and Chemical Conditions in the Western Cell

The ground surface of the Western Cell is predominantly above the average water surface elevation in the San Jacinto River. Prior to TCRA construction, surface elevations ranged from approximately 8 feet along the surrounding berms, to approximately 2 feet NAVD 88 in the center portion of the Western Cell. The ground surface was largely vegetated in the Western Cell prior to TCRA construction.

Surface soil concentrations of 2,3,7,8-TCDD in the Western Cell ranged from 2,710 to 7,040 ng/kg dry weight, or 108,000 to 127,000 ng/kg OC-normalized (Figure 1-3) in pre-construction sampling.

1.2.6 Pre-TCRA Physical and Chemical Conditions in the Northwestern Area

The Northwestern Area is part of the Western Cell; the two areas are connected by a relatively steep slope (approximately 2 horizontal to 1 vertical [2H:1V]) from the deep water of the Northwestern Area, up to the high ground in the Western Cell. The Northwestern Area differs from the Eastern Cell and the higher more southerly portion of the Western Cell the water is deeper. Prior to TCRA construction, typical bed elevations ranged from -20 to -10 feet NAVD 88.

The source material in the Northwestern Area consisted of highly plastic clay and silty clayey sand, with 42 to 66 percent fines, and water content that ranges from 27 to 137 percent. Pre-construction source material sampling in the Northwestern Area identified concentrations of 2,3,7,8- TCDD of 269 and 15,400 ng/kg dry weight or 14,000 and 114,000 ng/kg OC-normalized. From those two samples, the average concentration of source material in the Northwestern Area was 7,834 ng/kg dry weight, 64,000 ng/kg OC-normalized (Figure 1-3).

1.3 Relevant Operational History

In 1965, it is believed that the impoundments were constructed by forming earthen berms within the estuarine marsh, just north of what was then Texas State Highway 73 (now I-10), west of the main River channel. The two primary impoundments at the Site were divided by a central berm running lengthwise (north to south) through the middle, and were connected with a drain line to allow flow of excess water (including rain water) from the impoundment located to the west of the central berm, into the impoundment located to the east of the central berm (Figure 1-2).

In 1965 and 1966, pulp and paper mill wastes (both solid and liquid) were reportedly transported by barge and unloaded into the impoundments. The wastes deposited in the impoundments have been found to contain polychlorinated dibenzo-p-dioxins, polychlorinated furans (dioxins and furans), and some metals (TCEQ and USEPA 2006). Physical changes at the Site in the 1970s until present include regional subsidence of land in the area. This resulted in submergence of the eastern impoundment and partial submergence of the western impoundment and exposure of the dioxin waste to the San Jacinto River. Based on permit and bathymetric data reviews, and examination of aerial photographs, it appears dredging that occurred in the vicinity of the impoundments resulted in physical changes around the impoundments, especially in the Northwestern Area.

1.4 Previous Investigations

Previous investigations at the Site and the surrounding area were conducted to investigate the existing chemical conditions of several media: surface water, sediment, and biological tissue. Table 1-2 includes studies that were performed prior to the TCRA activities at the SJRWP. The Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the Site (Anchor QEA and Integral 2010) provides summaries and explanation of the data collected in each of the studies listed in Table 1-2. In addition, the draft Preliminary Site

Characterization Report (Integral and Anchor QEA 2011) provides summaries and explanations of more recent data collected, as part of the ongoing RI/FS for the Site.

Table 1-2

Previous Investigations as Outlined in the RI/FS Work Plan for the Site

Study	Reference	Media
The Houston Ship Channel Toxicity Study	ENSR and EHA 1995	Sediment, Surface Water
The Screening Site Inspection Report	TCEQ and USEPA 2006	Sediment
Sampling for the I-10 Dolphin Project	Weston 2006	Sediment, Subsurface Strata
The Houston Ship Channel Dioxin TMDL Study	University of Houston and Parsons 2006	Sediment, Surface Water, Biological Tissue
Samples Collected by TDSHS for the Fish Consumption Advisory Program	TDSHS 2007	Biological Tissue
Data generated by the November 1, 2009, Permit Evaluation Process 3	USEPA et al. 2009 Orion 2009	Sediment
The Houston Ship Channel PCBs TMDL Study	University of Houston and Parsons 2009 Koenig 2010, pers. comm.	Sediment
Samples collected for TCEQ in August 2009	URS 2010	Sediment, Surface Water

Notes:
1. Texas Commission on Environmental Quality – TCEQ
2. Total Maximum Daily Load – TMDL
3. Initiated by USEPA, USACE, and TCEQ, and managed by TCEQ and this currently includes a dataset for one permit application.

2 DESIGN BASIS AND REMOVAL ACTION WORK PLAN BACKGROUND

2.1 Administrative Order and Basis for the TCRA

MIMC and IPC entered into the AOC to conduct a TCRA in May 2010 (USEPA 2010a). The Action Memorandum for the TCRA (USEPA 2010b, Appendix A) stated that the TCRA was required to stabilize a portion of the Site (the TCRA Site) to abate the release of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans into the waterway from the impoundments north of I-10, until the Site is fully characterized and a remedy is selected (USEPA 2010a).

2.2 TCRA Objectives

The following removal action objectives for the TCRA were identified by USEPA in the Action Memorandum:

- Stabilize the impoundments to withstand forces sustained by the River.
    - The barrier design and construction must be structurally sufficient to withstand forces sustained by the River, including any future erosion and be structurally sound for a number of years, until a final remedy is selected and implemented (USEPA 2010c).
    - The technologies used to withstand forces sustained by the River must be structurally sufficient to withstand a storm event with a return period of 100-years until the nature and extent of contamination for the Site is determined and a final remedy is implemented.
- Prevent direct human contact with the waste materials, which according to the Action Memorandum, humans come into contact when accessing the Site by land and water (USEPA 2010b, Appendix A, IV.A.1; Page 9; 1st paragraph).
- Prevent benthic contact with the waste materials (USEPA 2010b, Appendix A, III.B).
- Ensure that the actions taken "are consistent with any long term remediation strategies that may be developed for the Site," which because the action constitutes source control, would be consistent with any long term remediation strategies that may be developed for the Site (USEPA 2010b, Appendix A).

2.3 Summary of Design Basis

As required by the AOC, the Respondents prepared a TCRA Alternatives Analysis (Anchor QEA 2010b) of potential options. Upon review of the TCRA Alternative Analysis, the USEPA selected a temporary granular cover designed to withstand a flow event with a return period of 100-years. The major construction elements of the removal were defined in Section 1.3 of the RAWP (Anchor QEA 2010a, as amended 2011) as follows:

- Construction of a security fence on the uplands to prevent unauthorized access to the Site. The first phase of this work was completed April 29, 2010, and the second phase was completed on January 4, 2011 (see Figure 2-1).
- Placement of warning signs around the perimeter of the impoundments and on the perimeter fence (see Figure 2-1).
- Site preparation, including clearing and grubbing vegetation as necessary, preparation of a staging area, and construction of an access road.
- Installation of a stabilizing geotextile underlayment over the Eastern Cell.
- Installation of an impervious geomembrane underlayment in the Western Cell.
- Installation of granular cover above the geotextile and geomembrane in the Western Cell, above the geotextile in the Eastern Cell, and in Northwestern Area.
- Use of appropriate health and safety and environmental control measures during construction.
- Design and implementation of an Operations, Monitoring, and Maintenance (OMM) Plan for the TCRA.

2.4 Revisions to the Removal Action Work Plan

A revision to the RAWP (Anchor QEA 2010a) was submitted and approved by USEPA in February 2011 that included updates to the nomenclature for the armored cap materials and removed outdated references. The RAWP was also updated to reflect the status of obtaining access to the Site along the TxDOT right-of-way (ROW) adjacent to the I-10 Bridge and other access-related changes, including use of the LaBarge property as a staging area for water-based construction. Additionally, the revised RAWP included three design revisions:

1. The addition of vents to the geomembrane in the Western Cell.
2. An update of the armored cap materials and designations.
3. A description of the armored cap edge detail.

The project Technical Specifications (Appendix C of the RAWP), the project Construction Drawings (Appendix D of the RAWP), and the Hydrodynamic Modeling report (Appendix I of the RAWP) were updated, as appropriate, to reflect these changes.

2.4.1 Texas Department of Transportation Requirements

On January 21, 2011, the Respondents entered into a License Agreement with TxDOT (TxDOT Agreement) (Appendix B) to construct and use a road, laydown and stockpile area, and turnaround area on the TxDOT ROW adjacent to the I-10 Bridge. As part of the Agreement, additional requirements were established for the construction and maintenance of these areas.

2.4.1.1 Debris Removal

A significant amount of debris was present in the areas adjacent to the TxDOT ROW and under the I-10 Bridge. Under Section 6.f of the TxDOT Agreement, these areas were required to be cleaned and cleared within a maximum of 180 days after the effective date of the TxDOT Agreement. Debris originating from under the I-10 Bridge included trash, vegetation, and tires. Debris removal activities, including stockpiling, on-site processing (tires only), and disposal are described in Section 4 – Land-Based Construction Activities. All debris from this area was loaded into roll-off boxes and transported to USEPA-approved Coastal Plains Recycling and Disposal Facility (RDF) in Alvin, Texas for disposal.

2.4.1.2 Guardrail

The TxDOT Agreement required the installation of a protective barrier adjacent to the access road constructed on the TxDOT ROW. The barrier would be placed on the south side of the road adjacent to the I-10 Bridge and be constructed using portable concrete traffic barriers (CTBs). In February 2011, the TxDOT Agreement was revised to permit a guardrail conforming to TxDOT Specifications Item 540 – Metal Beam Guard Fence to be constructed on the TxDOT ROW as an alternative to construction of a protective barrier using CTBs.

2.4.1.3 Coordination

The TxDOT Agreement required coordination between the parties throughout the TCRA construction process. As part of Section 2.a (page 3; Appendix B) of the TxDOT Agreement, prior to the initiation of the pre-construction survey, the Respondents and/or their contractors were responsible for coordinating with TxDOT to allow TxDOT the opportunity to have a representative present during the execution of the survey. As specified by Section 2.e (page 4; Appendix B) of the TxDOT Agreement, TxDOT was required to receive a three-day notice before the commencement of construction activities (including the pre-construction survey). Section 2.j (page 5; Appendix B) of the TxDOT Agreement required the Respondents to communicate to TxDOT when construction activities were completed. Additionally, under Section 10.e (page 11; Appendix B) of the TxDOT Agreement, the Respondents will receive notice should any future construction carried out by TxDOT disturb sediments of the San Jacinto River.

2.4.2 Geomembrane Vents

After consultation with geomembrane suppliers and additional consideration by the design team, it was determined that some allowance should be included for venting any gases that might be generated beneath the membrane.

Given the age of the impounded materials, it was considered likely that the majority of gas generation from organic degradation had already occurred and thus the potential for additional significant gas generation was considered to be low. However, the design team and Respondents added venting to provide additional protection of the geomembrane and the armored cap in the Western Cell. As described in Section 4.8, two vents were installed in the geomembrane at locations recommended by the installer.

2.4.3 Constructability Changes – Armored Cap

During construction planning, the Respondents, the design team, and the construction Contractor, USA Environment LP (USA), performed a constructability review of the armored cap material gradations and installation and verification procedures. A major finding of the review was that the Quality Assurance and Quality Control (QA/QC) of the original cap configuration could be complicated, because of the number of different types of materials used (recycled concrete and natural stone), and the different thicknesses of materials proposed for the cap. Based on this review, it was determined that simplifying the cap gradations and their required thicknesses would result in a more robust cap by increasing the minimum thickness for Armor Cap A and increasing the size of the former Armor Cap B rock to the Armor Cap B/C size that was used during construction. The revised cap configuration also simplified QA/QC in the field during construction without adversely impacting cap performance.

The following alterations to the original armored cap gradations were presented in the revised RAWP dated February 2011:

- Armor Cap A formerly was required to have a minimum thickness of 6 inches in the approved RAWP. In the revised RAWP, Armor Cap A has a required minimum thickness of 12 inches.
- Armor Cap B formerly was required to have a d_{50} of 5 inches. In the revised RAWP, Armor Cap B has a required minimum d_{50} of 6 inches, and was renamed to Armor Cap B/C.
- Formerly, there were two different material types for Armor Cap C – processed concrete and natural stone. In the revised RAWP, all Armor Cap C was comprised of the heavier natural stone material.
- Armor Cap E was replaced with Armor Cap D to minimize the number of different material types used and simplify armored cap construction. Armor Cap E was a minimum 24 inch thick layer, and the Armor Cap D replacement areas were either minimum 18 inch or 24 inch thick layers.

As a result of these changes, the revised RAWP provided a cap designed for the required 100-year flow event, but using a series of gradations and thicknesses that were easier to construct and confirm in the field. USEPA approved the changes requested in the work plan in a letter dated March 3, 2011.

2.4.4 Armored Cap Edge Detail

Additional information was included in the revised RAWP to describe a thickened cap edge, and an additional inset graphic was included in the revised RAWP's figures to show this detail. The thickened cap edge was included in the original approved RAWP, but was only depicted on the construction drawings in an appendix. This edge detail was included to reduce the potential for undercutting of the cap by scour forces, and was designed according to U.S. Army Corps of Engineers guidance (USACE 1994).

2.4.5 Access Changes

The initial TCRA construction design and schedule anticipated timely access to and use of both the TxDOT ROW for land access to the SJRWP and the Big Star Barge & Boat Company (Big Star) property for an equipment laydown and material stockpiling area.

The Respondents engaged in best efforts to obtain access to the TxDOT ROW. As noted above, the Respondents were not able to obtain access to the TxDOT ROW until they entered in to the TxDOT Agreement on January 21, 2011.

Despite the Respondents best efforts, access to the Big Star property could not be obtained. As a result, the Respondents pursued alternate locations for an equipment laydown and material stockpiling area. On January 25, 2011, once the TxDOT Agreement had been entered into and Respondents had required land access to the SJRWP, USA established an agreement to lease property owned by LaBarge Realty, LLC (LaBarge), located approximately 1¾ miles upriver from the SJRWP. This property provided an area to stockpile and manage the majority of the armored cap materials. Additionally, the LaBarge property had dock space that could be used to load and transport materials and equipment via barge to the SJRWP for water-based armored cap installation activities. USA also entered into a lease for property located at 16901 Market Street, Channelview, Texas, south of I-10, approximately 2.2 miles from the SJRWP, where the Respondents could establish an “Administrative Area” for containing construction offices that were originally intended by the Respondents to be located on the Big Star property.

As part of the TxDOT Agreement outlined in Section 2.4.1, the Respondents negotiated the right to construct an area on the TxDOT ROW to stockpile materials and stage equipment necessary for land-based construction activities. In lieu of establishing laydown and stockpile areas at the Big Star property, USA established these areas along the TxDOT ROW, as permitted, for the duration of the TCRA construction.

Respondents also made arrangements with their rock and concrete suppliers to store materials at their facilities prior to shipment to either the LaBarge property or the TxDOT ROW. This was necessary due to the fact that the LaBarge and TxDOT material storage areas did not provide as much capacity for such storage as the Big Star property would have provided.

3 COMMUNITY RELATIONS ACTIVITIES

Public relations throughout the TCRA construction consisted of both off-site and on-site interactions with elected officials, Harris County, TxDOT employees, Port of Houston representatives, and others.

3.1 Community Awareness Committee Meetings

Community awareness meetings were conducted throughout the TCRA construction effort. Meetings were held on the following dates:

- February 23, 2011
- April 20, 2011
- July 20, 2011

These meetings were hosted by USEPA, Respondents, and Anchor QEA, and provided a forum to engage any questions and concerns presented by the public. Anchor QEA prepared presentations for each event describing the up-to-date progress of construction, planned path forward, and estimated completion dates for portions of the TCRA.

3.2 On-Site Public Relations Activities

In addition to the community forums, the Respondents, Anchor QEA, and USA participated in on-site public relations activities by providing, to the extent practicable, guided tours of the TCRA Site construction operations. Visitors were allowed to observe the progress in the TxDOT ROW and SJRWP areas.

Guided tours were provided for the TCRA construction at various stages of completion to representatives from TxDOT, the Harris County Attorney's Office, congressional representatives of the United States and the State of Texas, the City of Baytown, Harris County Pollution Control, Harris County Precinct No. 2, the Galveston Bay Foundation, the Port of Houston Authority, a private citizen, and members of the media that attended a July 6, 2011, press conference convened by the Harris County Attorney's Office.

4 LAND-BASED CONSTRUCTION ACTIVITIES

Land-based construction commenced on December 8, 2010, with mobilization and site preparation activities, including the installation of additional perimeter fencing. Land-based construction activities were completed on July 28, 2011.

Land-based construction activities were cataloged in Daily and Weekly Construction Reports prepared by Anchor QEA and submitted to the USEPA during construction). The Daily Construction Reports contain information regarding dates and times, types of equipment, quantities of material, affiliations and numbers of persons on-site, photos, etc. The Weekly Construction Reports contain summaries of work completed, agency communications, projected work, and schedule tracking. These reports were consulted to prepare and present the information included in this and other sections of the document. The TCRA Daily and Weekly Progress Reports are provided in Appendix C. Photographs of the TCRA construction activities are provided in Appendix D. Information contained in those reports and in the photographic log is meant to supplement this and other sections of this RACR.

4.1 Mobilization and Site Preparation

The following subsections describe the mobilization and TCRA Site and support facility preparation work that occurred beginning on December 8, 2010, in preparation for the installation of the armored cap.

4.1.1 Perimeter Fence & Signs

The perimeter fencing was installed in two phases. The Phase I fencing was installed in April 2010 (see Appendix E of the RAWP for additional detail for the Phase I fencing). Construction of the Phase II fencing was initiated on December 8, 2010, with the mobilization of subcontractor National Fence Company (National Fence) to install the Phase II perimeter fence and signage. The appropriate means were taken to assess the fencing layout, on-site conditions, and location of utilities via the Texas One Call system. A survey of the Phase II fencing alignment was performed prior to the installation. There are two existing ExxonMobil pipeline bundles below the TxDOT ROW; ExxonMobil representatives located and marked the pipelines prior to digging the fencing postholes. Unbeknownst to Respondents, power cables for TxDOT's traffic camera monitoring system were also located in the fencing area. One of these cables was damaged during fence installation, and an additional utilities survey was performed with a TxDOT designated representative (TxDOT does not participate in the Texas One Call utility location system) to assess the location of any other such cables in the fencing area. Repairs to the cable were completed by a TxDOT contractor the week of December 20, 2010.

The Phase II fencing installation included clearing around and repairing the existing south fence at the Big Star property. The existing fence at the Big Star property was in good condition and only required minor repairs and the addition of razor wire. The major equipment used for clearing brush from the fence line and installing additional fencing included: skidsteers, support trucks, a jackhammer, and a generator. The schedule for the installation effort was affected by the abovementioned TxDOT traffic camera repairs, and resumed upon their completion. Included in the Phase II fence installation was the removal and reorientation of a 24 foot gate from its Phase I location to a new location in the Phase II alignment. The installation of the Phase II perimeter fence around the TxDOT ROW and Big Star property was completed on January 4, 2011. After the fencing was completely installed, an as-built survey was performed to assess any field alterations in the fencing layout. The completed fencing layout is shown on Figure 2-1.

Warning signs, No Trespassing signs, and USEPA Project Identification signs were installed as part of the TCRA. Signs were installed at established locations on-site and at ancillary areas, as deemed necessary by the Respondents and the USEPA. Warning and No Trespassing signs for the Phase I and Phase II fencing were delivered to the TCRA Site during the week of December 20, 2010. These signs were installed by January 4, 2011. The USEPA signs were approved and installed during the week of January 13, 2011. The locations of these signs were determined by a representative of the USEPA during a field visit on January 7, 2011.

The USEPA sign at the Administrative Area was removed following the completion of TCRA construction activities. All other Warning, No Trespassing, and USEPA signs remain in place. The Warning and No Trespassing signs will be subject to ongoing monitoring and maintenance as described in Section 9.

4.1.2 Central Berm Clearing

To install a nested monitoring well pair at the north end of the central berm and as a necessary component of the TCRA, vegetation from the top of the berm was cleared by USA with a Caterpillar (CAT) 320D trackhoe. Operations began on December 20, 2010, and were completed by December 22, 2010. Vegetation cleared from the central berm was stockpiled at an area inside the Western Cell near the southeast corner, until means for final disposal could be established (described below). On December 22, 2010, immediately after the top of the central berm was cleared of vegetation, USA installed approximately 100 feet of silt fence as an erosion control measure along the east side of the central berm at an area near the southern end of the berm, where the base of the berm was sparsely vegetated.

4.1.3 Access Road

The TxDOT Agreement described in Section 2.4.5 allowed for mobilization and construction of improvements to the TxDOT ROW prior to the armored cap installation. The improvements to the TxDOT ROW required for the completion of the TCRA included the construction of an access road leading to the SJRWP across the TxDOT ROW from the existing frontage road (East Freeway Service Road) on the north side of I-10, the establishment of equipment and construction materials storage area, and the construction of a truck turnaround area. Notice to TxDOT was required prior to certain actions related to such construction.

4.1.3.1 Road Construction

Prior to construction, TxDOT required that a survey of the TxDOT ROW be performed; this was completed the week of January 24, 2011. Construction of the access road and other improvements began the following week on January 31, 2011. Two culverts were installed to improve drainage along the proposed access road, and clearing and rough grading was initiated along the access road corridor. Once the culverts were installed, crushed concrete road base (CCRB) material was used to create a level surface. During the installation of the north to south culvert nearest the Big Star property, a thick layer of asphalt was encountered. The culvert was placed atop the asphalt layer and was covered with CCRB material to create a stable, level surface. Additionally, hay bales were placed at the inlets adjacent to the

TxDOT ROW in several locations to control sediment flow in surface water runoff. These, along with other environmental controls, are described in Section 4.1.4.

Rough grading was initiated along the TxDOT ROW to expose wet soils and allow them to dry in the ambient conditions. Prior to the completion of the rough grading and establishment of the road base, silt fencing was installed along the north side of the proposed access road and laydown area. The fencing stretched from the main access gate to the Western Cell. USA used a trenching machine to anchor the silt fence along these areas. Once the rough-graded areas were sufficiently dry, a geotextile layer was placed directly atop the graded surface. The CCRB material was then spread out across the geotextile using a dozer and then compacted with a roller to create a stable road base. The initial delivery date of the CCRB (February 9, 2011) was postponed, due to adverse weather and wet conditions on-site. Delivery and installation of the CCRB began on February 11, 2011. A CAT CS433E Roller (compacting), CAT D6 Dozer (rough grading), CAT 140H Road Grader (grading), and a Komatsu PC300LC Excavator (clearing) were used for the majority of the improvement work and access road installation along the TxDOT ROW. Access road construction was completed on February 18, 2011. After installation, water was sprayed atop the access road for dust control on an as needed basis throughout the project.

Following the construction of the access road, the truck turnaround and equipment laydown areas were constructed at the west end of the road. The same CCRB material was used to construct these areas. The completed turnaround area was delineated using orange construction safety fence. A dirt mound was placed in the middle of the turnaround to direct delivery traffic in this area. In addition to the road base installation, the overhead electric power for the billboards along the TxDOT ROW required relocating. These activities were completed on February 22, 2011. The completed access road, truck turnaround, and equipment laydown areas are shown on Figure 2-1.

4.1.3.2 Guardrail Installation

As part of the TxDOT Agreement, a 2,000-foot long barrier system was installed between the access road and the I-10 Bridge. The TxDOT Agreement was amended as of February 25, 2011, to allow use of a steel guardrail system as the barrier system instead of the originally planned CTB barriers.

Installation of the steel guardrail system began on March 1, 2011, by sub-contractor National Fence. TxDOT required that the soils excavated during the installation of the guardrail posts not be left in the TxDOT ROW. Until an approved disposal facility became available, all of the soils were stockpiled with the debris removed from under the I-10 Bridge (described below). National Fence completed the installation of the guardrail on March 10, 2011, with the exception of approximately 100 feet at the east end of the TxDOT ROW. This 100 foot section of guardrail was not installed to allow the debris stockpile to be removed from under the I-10 Bridge. Following the removal of the debris stockpile, the remaining 100 foot section of guardrail was installed on July 25 and 26, 2011.

4.1.3.3 Clearing, Transportation, and Disposal of Debris

The area along the TxDOT ROW contained a significant amount of debris (e.g., tires, trash, and vegetation), especially directly underneath the I-10 Bridge. As part of the TxDOT Agreement, this debris was removed and transported for off-site disposal. The debris removal began on February 24, 2011. A stockpile area for all of the items removed from under the I-10 Bridge was established on-site under a portion of the I-10 Bridge, near the east end of the TxDOT ROW with sufficient clearance to accommodate all of the debris. This stockpile area was also selected because truck traffic delivering materials to the TCRA Site did not need to travel this far to the east. Two stockpiles were established: one for tires and one for general debris. The latter included trash and vegetative debris, and the soil generated from excavation of the post holes for the guardrail installation. Heavy debris was removed using a skidsteer; vegetative debris (i.e., small trees) was cut at ground surface level using a chainsaw, then removed, and placed in the stockpile area. The stockpiling of debris items was completed on March 4, 2011, to allow for guardrail installation to be initiated. The debris piles were managed by USA using on-site equipment, until final disposal of debris was initiated on June 28, 2011.

Coastal Plains Recycling and Disposal Facility (RDF) in Alvin, Texas was selected for debris disposal and approved for use by the USEPA in an email dated April 26, 2011. Upon approval of the waste profile, the excavated soil and other debris was removed from the TxDOT ROW and disposed at the landfill. Roll-off boxes were delivered to the TxDOT ROW and loaded using a CAT 930 Loader, and then transported to Coastal Plains RDF. Debris removal was completed on July 7, 2011.

As mentioned above, all tires were managed in a separate stockpile apart from the other debris originating from under the I-10 Bridge. The tires were quartered on-site using a hand-held circular saw prior to disposal. Following quartering, the tires were loaded into a roll-off box on July 7, 2011, and the roll-off box was transported to Coastal Plains RDF on July 13, 2011.

4.1.4 Environmental Controls

In order to mitigate construction impacts to the areas surrounding the TCRA Site, environmental control best management practices (BMPs) were used, as specified in the TCRA construction specifications (Appendix C of the RAWP), the TxDOT Agreement, and the Contractor's Environmental Protection Plan (EPP).

4.1.4.1 Dust Control

Southeast Texas experienced a severe drought during the TCRA construction operations. The lack of rain created the potential for dust generation from the access road, truck turnaround, and stockpile areas. As outlined in the TxDOT Agreement, dust control measures (TxDOT Specifications Manual – Item 204 "Sprinkling") were implemented, as needed, to minimize dust generation. A water truck was used throughout the construction and applied water to the access road, truck turnaround, stockpile areas, and the LaBarge property several times per day to prevent dust migration.

Additionally, during the delivery and application of Portland cement to the interior of the Western Cell, dust mitigation was also a concern. The dust generated during unloading of the Portland cement was generally minimal and dissipated before reaching the south berm. USA crew members covered the Portland cement discharge point with plastic sheeting and also used hoses to spray water, as necessary, to control the propagation of dust during the delivery of Portland cement to the Western Cell.

4.1.4.2 Hay Bales

As outlined in the Contractor's EPP, hay bales were used for sediment control at primary drainage points on-site (i.e., surface water inlets and stormwater discharges). The hay bales were placed adjacent to the TxDOT ROW in several locations: at a culvert near the Big Star east gate, at the southwest corner of the Western Cell, and at the east end of the TxDOT ROW by the River. Additional hay bales were added, as necessary, to prevent high tides from inundating these areas, particularly in anticipation of the tidal elevation on March 18, 2011, which was predicted to be the 20-year record high tide. The hay bales were first placed the week of February 7, 2011, and continued to be managed, as needed, for the duration of the project.

4.1.4.3 Silt Fence

The Contractor's EPP outlined the use of silt fence as a temporary stormwater control method. A silt fence was placed between the upland areas of the TCRA Site and the receiving waters. USA began placing silt fence at the TCRA Site the week of December 20, 2010, and as land-side construction progressed, additional fencing was installed in areas, as needed, to prevent impacts to the surrounding waters. In conjunction with the access road construction mentioned above, USA installed silt fencing adjacent to the TxDOT ROW. In accordance with the Contractor's EPP, monitoring of the silt fence conditions occurred on a daily basis and after storm events.

4.1.4.4 Equipment and Vehicle Decontamination

The Contractor's EPP also outlined the procedures to decontaminate all equipment and vehicles operating in and around the TCRA Site during construction. It was anticipated that operations, specifically the clearing and grubbing within the Western Cell, could potentially encounter impacted (i.e., dioxin-contaminated) material. For equipment and vehicles working in this area, an initial dry decontamination was performed by shoveling, scraping, and brushing off all loose material onto a decontamination pad. If deemed necessary, wet decontamination was used prior to demobilizing from the SJRWP. Wet decontamination was performed only on a case-by-case basis. After clearing and grubbing was completed in the Western Cell, equipment and vehicles operating in this area were visually inspected and dry decontaminated.

4.1.5 Administrative Area

Additional mobilization and preparation activities were necessary to establish the off-site Administrative Area, located at 16901 Market Street in Channelview, Texas. This area was located approximately 2.2 miles from the Site. Road base aggregate was used by USA to establish a level area for parking. Administrative facilities on-site included separate office trailers for the USEPA, Anchor QEA, and USA. Utility services were installed to provide water, sewer, telephone, and internet access to the three office trailers. A sign was installed that identified the location as the Administrative Area for the TCRA construction. Security measures taken to secure the Administrative Area against theft and vandalism for this and other areas is described below in Section 4.3 – Site Security, and included the use of a roving security patrol or a remotely monitored camera.

4.2 Health & Safety

Prior to and during implementation of the TCRA, the Respondents engineering and oversight team, including Anchor QEA and their subcontractors, worked under the Health and Safety Plan prepared for and approved by USEPA under the Remedial Investigation/Feasibility Study for the SJWRP (Unilateral Administrative Order, Docket No. 06-03-10, to IPC and MIMC on November 20, 2009 (USEPA 2009b)). The Contractor's USA Health and Safety Plan (CHASP) was submitted to the USEPA the week of January 31, 2011, after access-related information was available that was needed before the CHASP could be completed. Potential health and safety (H&S) issues were presented by USA's Health and Safety Officer (HSO) at each morning's tailgate meeting. The intent of these meetings was to inform all workers who would be on-site of certain risks and potential safety hazards. In addition, all TCRA Site visitors were required to sign in at the Administrative Area and receive a H&S briefing from USA's HSO before being escorted to the TCRA Site.

A meeting was held with the Channelview Fire Department on March 1, 2011, to discuss response procedures, in the event of an emergency during the TCRA construction. Participants in the meeting included Chief Riker of the Channelview Fire Department, USEPA, Respondents, and USA's HSO. Chief Riker was provided a copy of the Emergency Contingency Plan for the Site and provided comments to the plan.

A memorandum from USA dated February 14, 2011, amended the CHASP to outline the delineation of the Exclusion Zone and the Restricted Zone at the Site; the latter is described below in Section 5 – Water-Based Construction Activity. The Exclusion Zone included all land-side work areas within the impoundment footprint above a ground surface elevation of -2 feet NAVD 88. During normal construction activities in this area of the TCRA Site, workers had an increased likelihood of coming in contact with dioxin-contaminated waste. All workers in the Exclusion Zone were required to have current 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification and an established medical monitoring program. Additionally, Level D Personal Protective Equipment (PPE) was required while working in this area, including hard hats, high-visibility reflective vests, safety glasses, and steel-toed boots. Other PPE, such as wearing face shields and leather chaps while operating a chainsaw, was selected on a task-specific basis.

The above mentioned memorandum also provided a drawing that indicated locations for a Contamination Reduction Zone (CRZ) and a wet decontamination area. Boot decontamination stations were provided for the workers entering and exiting the TCRA Site. A new boot wash system was installed the week of March 14, 2011. Equipment decontamination occurred prior to removing the equipment from the CRZ. A revised version of the Contractor's final CHASP, incorporating the changes implemented by the memorandum, was submitted the Respondents on March 21, 2011, and subsequently submitted to the USEPA on April 14, 2011.

No injuries to Site workers occurred during TCRA construction. The most significant H&S issue encountered during the TCRA construction was the emanation of ammonia vapors from a nearby barge on the south side of the I-10 Bridge that was detected by Site crew members March 25, 2011. Vapors were observed emanating from an open 55 gallon barrel. A brief suspension of construction operations at the TCRA Site was necessary to limit workers' exposure to the vapors. The USA HSO met with Southwest Shipyard representatives, who indicated that the barge was purging air from the cooling system. The USA HSO requested advanced notification for future ammonia off-gassing. The USEPA, Anchor QEA, and USA met representatives of Southwest Shipyard and Duval Towing, who indicated that operations would be modified to prevent ammonia vapors from reaching the

TCRA Site. No ammonia vapors were noted by crew members following this March 25, 2011 meeting.

4.3 Site Security

Incidents of theft and vandalism occurred in the months prior to and during the initial phases of TCRA construction. During the week of January 3, 2011, several incidents occurred in the TxDOT ROW involving the theft of copper and fiber optic cable, tools, and a welding machine. The Site fencing was vandalized by the thieves during these incidents to gain entry into the TxDOT ROW. Following these incidents, the Respondents addressed Site security by implementing active security measures. Initially, an off-duty Sheriff's Officer was hired to provide nighttime security.

Additional security measures were implemented after Respondents entered into the TxDOT Agreement. USA provided a roving security patrol to monitor the TxDOT ROW and SJRWP areas, the Administrative Area, and the LaBarge property from 7:00 p.m. to 7:00 a.m. as a permanent Site Security Plan (SSP) was being finalized. Per the requirements of the Project Specifications (Appendix C of the RAWP), USA prepared and submitted an SSP. The draft SSP was submitted to the Respondents on February 10, 2011; the final SSP was submitted to the Respondents on February 28, 2011, and to the USEPA on March 1, 2011. This document provided contact information for and duties of the Responsible Person (USA Project Manager). Also identified in the SSP were the areas covered and security activities to be performed for the duration of the TCRA construction.

As outlined in the SSP, security measures were implemented at each of the areas involved in the TCRA construction operations (i.e., Administrative Area, LaBarge property, and the TxDOT ROW and SJRWP area). A manned security guard shack was established at the westernmost point of the access road along the TxDOT ROW and was staffed throughout daily working hours. All visitors were required to first sign-in at the Administrative Area and receive a health and safety briefing before being admitted to the TxDOT ROW and TCRA Site through this security checkpoint.

As mentioned earlier in this section, security after working hours was initially provided by a roving security patrol from 7:00 p.m. to 7:00 a.m. to monitor all three areas. Three remote security cameras were setup at the TxDOT ROW and Administrative Area and one remote camera was installed at the Administrative Area on March 8, 2011. The guard shack and camera installation on the TxDOT ROW was also completed by March 18, 2011; two remote cameras were installed along the TxDOT ROW, one at the east end near the River, and one at the main gate near the guard shack. All three cameras were monitored at an off-site service center location for the duration of the project. The cameras were monitored 24-hours per day, passively from 6:00 a.m. to 7:00 p.m. and actively from 7:00 p.m. to 6:00 a.m. After the security cameras were installed and were noted to be functioning properly, the manned roving security patrols were discontinued.

A remote camera was not installed at the LaBarge property; after-hours security at that location was provided by locking the gates at night. No incidents of theft or vandalism occurred at the LaBarge property for the duration of the TCRA construction.

4.4 Western Cell Clearing and Grubbing

The Western Cell of the TCRA Site consisted of an upland vegetated area. This area was overgrown with surface and above-ground vegetation (e.g., grasses, shrubs, and small trees) that needed to be removed prior to geotextile and armored cap installation. Clearing and grubbing operations began, as described in the Project Technical Specifications on the central berm on December 20, 2011 (see Section 4.1.1), and on the remainder of the Western Cell on February 23, 2011.

Vegetation cleared from the central berm in December 2010 (see Section 4.1.1), was processed along with the vegetation from the Western Cell. The USA crew used chainsaws to remove the stumps from this vegetation, and the stumps were returned to the Western Cell for subsequent cover by geotextile and geomembrane layers. The methods for stump processing were described in a Request for Information (RFI) from USA sent on March 22, 2011. After the stumps were removed, a visual inspection was performed on the above-ground portion of the vegetation; if paper mill sludge was observed on any portion of the vegetation, the affected portion of the vegetation was segregated and remained in the Western Cell for subsequent cover.

The above-ground portion of the vegetation was transported to the USEPA-approved Atascocita RDF in Humble, Texas for disposal. Loading and hauling operations for the above-ground vegetation began on March 22, 2011. This vegetation was removed from the Western Cell using an excavator with hydraulic thumb to load the stockpiled above-ground vegetation into roll-off boxes. The roll-off boxes were transported to the Atascocita RDF. No analytical report for the vegetative material was required, as all material that was sent to the landfill was designated as above-ground, non-contact vegetation. Loading and hauling operations were completed on April 12, 2011. Appendix F contains a technical memorandum that describes the clearing and grubbing operations.

4.5 Stabilization of Low-Lying Areas

Initial attempts to access portions of the Western Cell were difficult for the Contractor due to soft soils. In a memorandum dated May 2, 2011 (Appendix G), USA presented a path forward to prepare the Western Cell to allow construction equipment access to the entirety of the Western Cell to install the LLDPE liner and armor rock cover. The memorandum recommended the addition of Portland cement to low-lying portions of the Western Cell at an 8 percent by weight mix ratio to stabilize the low-lying areas. After stabilization, construction equipment was able to access the entirety of the Western Cell. The procedures used to stabilize the Western Cell using Portland cement are described in the following sections.

4.5.1 Bench Scale Tests

USA performed bench scale tests to evaluate reagents and mix ratios to achieve the target stabilization. USA consulted a geotechnical engineer to evaluate the stability of sediments and determine whether, for a given admixture type and mix ratio, the stabilized area would allow for access of construction equipment. The two reagents tested by USA were lime and Portland cement. Various percentages of each reagent, including a control batch with no reagent added, were added to paper mill sludge that had been collected from the Western Cell. The samples were cured for 24 and 48 hours. A pocket penetrometer was used to assess each sample's compressive strength, which was reported in tons per square foot (tsf). Table 4-1, adapted from USA's memorandum, outlines the percent mixture tests and their results.

Table 4-1

Reagent Bench Test Results

Reagent Type	Curing Time (Hours)	Strength at Various Mix Ratios By Weight (tsf)			
		4%	6%	8%	10%
Portland Cement	24	0.0	1.4	3.0	3.4
	48	1.1	1.6	3.3	4.0
Lime	24	0.0	0.0	0.0	0.0
	48	0.5	0.5	0.5	0.5

4.5.2 Stabilization Mixture Design

The bench scale tests indicated that an 8 percent by weight admixture of Portland cement provided USA's target strength of two tsf at both 24 and 48 hours. Based on the available Site data and bench test data, USA's geotechnical engineer recommended that an 8 percent by weight mixture of Portland cement be mixed into the upper 3 feet of soft sediment. USA used the 8 percent mixture as the target, but allowed for a 1 percent deviation (minimum 7 percent by weight mixture). The following calculation was performed to assess the percent mixture and required amount of Portland cement necessary for each delivery:

$$Mix\ Ratio = \frac{Tons\ of\ Reagent\ per\ Load}{Area \cdot Mixing\ Depth \cdot Sediment\ Unit\ Weight}$$

where:

Mix Ratio = the percent by weight of a given stabilization reagent,

Tons of Reagent per Load = weight of reagent delivered to the TCRA Site (22 to 25 tons),

Area = footprint to receive the reagent for stabilization (2,800 square feet),

Mixing Depth = depth to which the reagent will be mixed (3 feet), and

Sediment Unit Weight = estimated unit weight of sediment (1 ton per cubic yard).

A delivery of 22 tons would yield a mixture of 7.1 percent to stabilize a 2,800 square foot area to 3 feet below ground surface for the given conditions, whereas a delivery of 25 tons would yield a mixture of 8 percent.

4.5.3 Western Cell Stabilization

Stabilization began at the south end of the Western Cell and continued in segments progressively toward the north, terminating at the north end of the Western Cell. A temporary water control berm was constructed at the north end of the Western Cell to minimize the potential for tidal water to inundate the Western Cell during stabilization activities. As established in the abovementioned memorandum (Appendix G), the Western Cell was divided into nine segments, each approximately 5,600 square feet in area that followed the centerline of the U-shaped low-lying portion of the Western Cell. A temporary water control berm with a crest elevation of approximately 2.5 feet NAVD 88 was constructed using CCRB and 6-milliliter (mil) thick polyethylene sheeting to divide each segment prior to addition of Portland cement.

Two truckloads of Portland cement (approximately 25 tons each) were mixed into each 5,600 square foot segment using long stick excavators; qualitative monitoring was performed to assess bucket and mix depth during the application. Each segment was allowed to cure for a minimum of 24 hours and then was tested with a pocket penetrometer. Stabilization efforts were completed the week of May 20, 2011; a total of 430 tons of Portland cement were used for stabilization in the Western Cell.

4.6 Western Cell Surface Grading

Following stabilization of low-lying portions of the Western Cell using Portland cement, the surface of the Western Cell was graded to provide a smooth working surface for the installation of the non-woven cushion geotextile and geomembrane layers. The surface grading was completed by adding a thin lift (approximately 6 inches) of CCRB to the surface of the Western Cell. CCRB was delivered to the Western Cell at the south end of the central berm and loaded onto Morooka low-ground pressure dump trucks using a CAT 930 front-end loader. The Morooka trucks delivered the CCRB material to the leading edge of previously graded areas of the Western Cell, traveling only on placed CCRB. A CAT D5 dozer and skidsteers were then used to spread and grade the CCRB over the surface of the Western Cell; the dozer and skidsteers tracked only over areas of placed CCRB material to avoid contact with the ground surface in the Western Cell. A CAT long-reach excavator was also used to assist placement of CCRB material in portions of the Western Cell. The surface grading was completed on May 24, 2011, and a survey of the Western Cell was completed on May 25, 2011. A total of 3,680 tons of CCRB was used to grade the surface of the Western Cell.

4.7 Geotextile Installation

Once surface grading in the Western Cell was complete, a layer of 12-ounce (oz) non-woven cushion geotextile was deployed across the Western Cell as depicted on the Construction Drawings. Installation began on May 25, 2011. A total of 30 rolls of 12-oz geotextile were used to cover the Western Cell; of the 30 rolls, 25 measured 15 feet wide by 300 feet long and five measured 15 feet wide by 400 feet long.

Two crews of workers (one from USA and the other from USA's subcontractor Envirocon Systems, Inc. [Envirocon]) were used to deploy the geotextile. The rolls were delivered to the crew at the central berm using a Skytrak rubber tired forklift. An all-terrain vehicle (ATV) operated by one crew member was used to unroll the geotextile in an east-to-west direction across the Western Cell. The remaining crew members guided the geotextile to provide a 1 foot overlap with the adjacent panel of geotextile. The overlapping sections of adjacent geotextile panels were heated using a Leister heat gun or similar device to weld the adjacent panels together ("Leister" or heat welded seam). Sand bags filled with CCRB material were used as weights to prevent the geotextile from shifting out of position during deployment.

At the borders of the Western Cell, atop the central and south berms, a 2 foot wide and 2 foot deep anchor trench was excavated to secure the edge of the geotextile. A Kubota mini-excavator was used to dig the anchor trench. The anchor trench was initially aligned along the inside slope of the central berm, but paper mill sludge was encountered at this location. As a result, the anchor trench was relocated to the top of the central and south berms. Earthen materials were observed in the anchor trenches installed at the top of the berms.

No anchor trench was excavated along the western side of the Western Cell, as paper mill waste was encountered in a test pit along the original trench alignment. The geotextile layer was instead extended over the top of the western berm. The geotextile extended to the north end of the Western Cell over the top of the temporary erosion control berm; no anchor trench was installed at the north end of the Western Cell, in accordance with the Technical Specifications. Installation of the 12-oz geotextile layer was completed on May 27, 2011.

Following the installation of the geomembrane (described in Section 4.8), a 16-oz non-woven cushion geotextile layer was deployed in the Western Cell. The 16-oz geotextile was installed using similar means and methods as the 12-oz geotextile installation. The anchor trenches were backfilled once sections of the Western Cell were covered with the 16-oz geotextile. Once the anchor trench on the central berm was backfilled, another layer of 16-oz geotextile was placed atop the central berm and overlapped with the existing adjacent layers in the Western and Eastern Cells. The deployment of the 16-oz geotextile was completed on June 2, 2011.

4.8 Geomembrane Installation

As described in the RAWP, geomembrane was installed over the Western Cell. The specific geomembrane selected by USA was GSE UltraFlex 40-mil thickness smooth linear low density polyethylene (LLDPE); this material was approved for use on February 1, 2011, and was the geomembrane used during TCRA construction.

Installation of the geomembrane began on May 26, 2011, in portions of the Western Cell already covered with the 12-oz non-woven cushion geotextile layer. Prior to deploying the geomembrane panels, the top of the 12-oz geotextile was inspected and cleared of any debris that could puncture or otherwise damage the geomembrane. USA and Envirocon crews used a Kobelko SK210 excavator equipped with a spreader bar and stationed atop the central berm to deploy the LLDPE panel sections; the crew members used an ATV holding the free end of the panel to unroll the geomembrane across the Western Cell in an east-to-west direction.

Sand bags with CCRB material were placed along the edges of deployed LLDPE panels to prevent excess movement. As described above for the geotextile installation, the geomembrane extents were extended such that the edge of the panels extended over the western berm in lieu of using an anchor trench. Similarly, the geomembrane was extended over the temporary erosion control berm at the north end of the Western Cell; no anchor trench was installed at the north end of the Western Cell, in accordance with the Technical Specifications.

Adjacent panels of the geomembrane were positioned with sufficient overlap to allow for a double seam fusion weld. Industry standard double-seam pressure testing was performed in discrete locations along the welds for each LLDPE panel. After each pressure test, a patch was installed over the affected area and secured by an extrusion weld. After installation, the integrity of each patch was tested using a vacuum box. A summary of the panel layout, including a figure, are provided in Appendix H.

As outlined above in Section 2.4 – Revisions to the Removal Action Work Plan, the revised RAWP presented a design modification to the geomembrane post-installation. Vents were added to the installed geomembrane layer to allow gases generated by organic degradation of the underlying materials to escape. Two 2 inch diameter vents were installed at the top of the west slope of the central berm. A piece of LLDPE was welded around three sides of each of the vents to redirect stormwater runoff around the vent.

Installation of the LLDPE geomembrane was completed on June 1, 2011. A figure depicting the area covered by the geomembrane is included as Figure 4-2.

4.9 Armored Cap Placement

Primarily low-ground pressure land-based equipment was used to install the armored cap in the Western Cell and portions of the Eastern Cell of the SJRWP. In general, the equipment used for armored cap placement in both areas was similar and included the following CAT equipment: long-reach excavator, loader (930 and 950), track loader, and D5 dozer. Skidsteers were also used to deploy the armored cap aggregate in a portion of the Western Cell. The armored cap was installed at the locations shown on Figure 4-1.

4.9.1 Eastern Cell

Armored cap material was placed in the Eastern Cell using both land-based and water-based methods. The latter is discussed in Section 5 – Water-Based Construction Activities. For land-based armored cap placement in the Eastern Cell, preparations were necessary prior to armored cap placement. On March 10 and 11, 2011, the slopes of the south and central berms were graded to create a stable surface for the installed armor rock. A thin layer of CCRB was installed over a limited portion of the eastern face of the central berm to assist with the creation of a stable slope on the central berm.

Land-based armored cap placement in the Eastern Cell began with Armor Cap A, B/C, and D rock placement on the south and central berms. Once the grading was completed, a layer of geotextile was placed over the south and central berm faces. The geotextile was deployed by hand and adjacent panels of geotextile were overlapped by 3 feet. These upland portions of the Eastern Cell were surveyed by USA's subcontractor Chris Ransome & Associates (CRA) on March 17, 2011, who used orange-painted stakes or rebar and painted markings directly onto the geotextile surface to mark the extents of the Armor Cap A, B/C, and D areas in the Eastern Cell as a guide for the equipment operators.

Following the installation of geotextile and surveying, armored cap placement began on the south berm of the Eastern Cell on March 17, 2011, with the installation of Armor Cap A. A front-end loader was used to transport the material from a temporary stockpile at the intersection of the south and central berms. The material was brought to a long-reach excavator operating on the south berm. As the Armor Cap A was being placed, a spotter in front of the excavator used a stick demarcated with the appropriate cap layer thickness to determine the in-place thickness of the armor layer. Placement of Armor Cap B/C on the south berm of the Eastern Cell began on March 18, 2011. Delivery and installation of this material was performed similarly to the Armor Cap A installation.

After the armored cap was placed on the south and central berms, installation of the armored cap continued into the underwater portion of the Eastern Cell. The long-reach excavator was positioned on the south or central berm and extended over the water to place the armored cap as far as the excavator could reach from this position. To deploy geotextile in this area below the water surface, USA crew members used a combination of crew members in waders or in a work boat to deploy the geotextile. Sections of rebar were used to hold the geotextile in place and mark the edge of the geotextile so the adjacent panel could be overlapped by 3 feet.

After the long-reach excavator placed the armored cap in the Eastern Cell as far as it could reach from an upland position, USA constructed an access point to extend into the Eastern Cell. This access point was built several feet thick and approximately 20 feet wide to provide a working surface that was higher than the surface water elevation in the Eastern Cell. The intent of the access point was to provide better access to the portions of the Eastern Cell that were normally covered with surface water, so land-based equipment could be utilized for armor cap placement in those areas. USA began constructing the rock access point on March 24, 2011, using Armor Cap A. The armored cap material was delivered to the access point area by a tracked loader and was then graded out by a dozer.

On March 28, 2011, during construction of the access point sediment displacement (heaving) adjacent to the area was observed. Heaving was observed on the northern side of the rock access point. Heaving was also observed while the long-reach excavator tracked onto a crane mat located on a newly-constructed portion of the platform. Sediment was heaved upward and outward on the northern side of the access point, and sediment was forced between overlapping sections of geotextile in three areas, which were visible above the water surface on March 30, 2011. Anchor QEA required that USA place additional geotextile and Armor Cap A atop these sections, as needed, to close the overlap and cover the sediment. Based on survey information and visual inspections, heaving of the subgrade appeared to be limited to within 20 feet of the access point, and did not extend beyond the horizontal limits of the TCRA Site. After heaving was observed, construction of the rock access point was discontinued.

After construction of the access point was discontinued, USA installed the armored cap in portions of the Eastern Cell that could be accessed by land-based equipment without the construction of access points. Geotextile and Armor Cap A, B/C, and D were installed along the eastern slope of the central berm, in accessible portions of the Eastern Cell, and along the remaining sections of the southern berm. The armored cap rock was delivered to the TCRA Site and transported by the front-end loader along the central or southern berms to the long-reach excavator. The excavator placed the armored cap rock out along the central berm and Eastern Cell armoring the areas established by the surveyors. Operations along the south berm concluded on April 6, 2011, with the placement of Armor Cap B/C. Armor rock installation continued along the central berm and reachable portions of the Eastern Cell near the north end of the central berm until April 20, 2011.

The final land-based construction item for the Eastern Cell was the placement of Armor Cap A by removal of the rock access point. The Armor Cap A used to construct the access point was removed from the leading end of the rock platform using the long-reach excavator and side-cast to the north and south of the access point atop previously-installed geotextile panels. The removal of the access point was completed on April 28, 2011.

Because of the sediment heaving observed during construction of the access point, USA modified their approach to armored cap placement in the Eastern Cell. Rather than construct additional access points to cover the Eastern Cell at elevations higher than -2 feet NAVD 88, the use of land-based placement was discontinued in these areas and the remaining portions of the Eastern Cell were covered via water-based placement, as described in Section 5 – Water-Based Construction Activities.

4.9.2 Western Cell

The Western Cell received two types of armor rock cover: Armor Cap B/C and Armor Cap D (Figure 4-2). The former comprised the majority of the armored cap for the Western Cell. Armor Cap B/C was installed with a minimum thickness of 12 inches. Armor Cap D was installed with a minimum cap thickness of 18 inches at the northern end of the Western Cell, and a minimum thickness of 24 inches across the middle portion of the central berm stretching into the Western Cell (Figure 4-1). A survey, performed by CRA, of the unarmored portion Western Cell was completed on June 3, 2011, to identify the horizontal limits that would receive Armor Cap B/C or Armor Cap D. The transitions were marked with orange spray paint atop the 16-oz geotextile layer.

Following the installation of the 16-oz geotextile, placement of Armor Cap B/C in the Western Cell began on June 2, 2011. Armor Cap B/C deliveries were received at temporary stockpile areas at either the central berm or the laydown and stockpile area established at the western entrance to the TxDOT ROW. A front-end loader and two Morooka trucks were used to load and transport the armor rock from the stockpile areas to the Western Cell.

The Morooka trucks delivered the rock to a long-reach excavator operating in the Western Cell. The long-reach excavator was used to distribute the armor rock at the appropriate thickness across the surface of the Western Cell. The long-reach excavator operated from wooden mats placed atop the armor rock to limit ground pressure on the subgrade and geosynthetics. A spotter at the front of the excavator used a stake demarcated with the appropriate cap thickness to assist the operator with achieving the required thickness of armor rock placement. In addition to the long-reach excavator, a low ground pressure skidsteer was also used to place armor rock in a portion of the Western Cell; a spotter was also employed to assist the skidsteer operator to achieve the required armor thickness.

Placement of the Armor Cap B/C began in the southeast and southwest portions of the Western Cell and continued northward and toward the cell interior. Placement of Armor Cap B/C was suspended from June 13, 2011 to June 20, 2011, due to maintenance of the scales at HPP, the supplier for Armor Cap A and B/C. Receipt of Armor Cap B/C resumed on June 21, 2011. The armor placement operations reached the northern temporary erosion control berm by the end of the day on June 21, 2011. At this point, the long-reach excavator was used to uninstall the temporary erosion control berm. The removal of the berm was scheduled for the following day; however, it was postponed due to heavy rains. The temporary erosion control berm was completely removed on June 23, 2011; the CCRB used to construct the berm was spread over a 30 foot wide area at the north end of the Western Cell and subsequently covered with Armor Cap B/C.

USA and CRA crews began surveying the installed B/C armor rock on June 21, 2011, and completed the progress surveys on June 23, 2011. Five locations were identified that did not achieve the required minimum 12-inch thickness of Armor Cap B/C. Additional horizontal delineation completed at 15 foot intervals around these five locations and determined that placing additional cover over a 30 foot diameter area would achieve the required thickness. On June 24, 2011, USA placed additional cover in an approximate 30 foot diameter around these five locations. CRA surveyed the armored cap immediately following placement of additional cover to verify cap thickness met the required 12 inch minimum cover. Armor Cap B/C rock installation was completed on June 24, 2011. The total B/C rock material delivered to the TCRA Site for the cap installation was 11,128 tons.

Installation of Armor Cap D in the Western Cell began on July 6, 2011. The Armor Cap D was delivered to the laydown area near the main TxDOT ROW access gate and loaded onto Morooka trucks using a front-end loader. The Morooka trucks delivered the Armor Cap D to the central berm and Western Cell areas. Once transported to the Western Cell, Armor Cap D was unloaded and spread to the required thickness using a long-reach excavator. As before, a spotter used a stake demarcated with the appropriate cap thickness to assist the operator with the armor rock placement.

USA and CRA began progress placement surveys of the Western Cell Armor Cap D rock on July 8, 2011. The intent of the surveys was to evaluate whether areas of the Armor Cap D rock satisfied the required minimum thickness of 18 or 24 inches. Upon completion of the surveys on July 12, 2011, none of the cap thickness surveys indicated deficiencies; therefore, no rework of the Armor Cap D rock areas was required. The installation of the Armor Cap D rock was also completed on July 8, 2011.

4.10 Demobilization

Demobilization of the land-based TCRA construction areas and equipment began on July 13, 2011. Materials used to assist the field crew in the identification of armored cap placement areas (stakes and rebar) were cleared from the TCRA Site. Rental equipment used to construct the armored cap in the Western Cell (two Morooka trucks, a front-end loader, and a long-reach excavator) was returned to the rental company. Security equipment was demobilized from the TCRA Site, including the guard building at the main entrance to the TxDOT ROW and the three security cameras. The gravel access road was graded.

In addition, remaining Armor Cap C and D rock (970 tons and 1,720 tons, respectively) were stockpiled at an off-site facility located approximately 10 miles from the Site to be available for use in future maintenance activities if necessary. Improved sign posts were constructed and installed for warning signs placed around the perimeter of the SJRWP. If needed for future OMM activities, additional signs and posts have been stored at an off-site facility.

Demobilization from the Administrative Area included removal of the sign identifying the Administrative Area, removal of a dumpster, disconnecting all utilities from the three field trailers, and removal of the three field trailers from the Administrative Area. Demobilization activities were completed by July 28, 2011.

5 WATER-BASED CONSTRUCTION ACTIVITIES

Water-based construction activities were performed by Shirley & Sons, who were subcontracted to and directed by USA. Delivery of equipment to the LaBarge property commenced on January 31, 2011, and delivery and stockpiling of armored cap materials at the LaBarge property began on February 1, 2011. Placement of Armor Cap rock in the Eastern Cell began on February 17, 2011. Initial water-based placement of Armor Cap rock in the Eastern Cell and Northwestern Area was completed on May 19, 2011.

Following the completion of bathymetric and manual probing surveys of the Eastern Cell and Northwestern Area, several locations were identified that required additional placement of Armor Cap rock. The additional placement commenced on June 27, 2011, and was completed on July 11, 2011. Demobilization of materials and equipment from the LaBarge property was completed on July 15, 2011.

Water-based construction activities were cataloged in the TCRA Daily and Weekly Progress Reports (Appendix C), prepared by Anchor QEA and submitted to USEPA during construction. The Daily Construction Reports contain information regarding dates and times, types of equipment, quantities of material, affiliations and numbers of persons on-site, photos, etc. The TCRA Weekly Progress Reports are provided to supplement this and other sections of the document. Photographs of the TCRA construction are provided in Appendix D.

5.1 Mobilization and Site Preparation

As outlined in Section 2.4.5 – Access Changes, the initial TCRA construction design anticipated using the Big Star property for an equipment laydown and material stockpiling area. Despite the Respondents best efforts, access to the Big Star property could not be obtained. As a result, the Respondents and USA pursued alternate locations to use for material stockpiling and transloading operations. This led to a series of agreements for alternate locations (as described in Section 2.4.5), including an agreement to lease a portion of the LaBarge property, located approximately 1¾ miles upriver from the SJRWP. As a result of the access changes, the construction plans and schedule were revised to address the revised access arrangement.

5.1.1 LaBarge Property Preparation

Prior to beginning the stockpiling and transloading operations at the LaBarge property, seven surface soil samples (including one duplicate) were collected at the property on January 25, 2011. These samples were collected to establish pre-construction conditions on-site. The sampling process is described in the TCRA Daily Construction Reports (Appendix C) and the sample results are provided in Appendix I.

Equipment for material stockpiling and transloading was delivered beginning on January 31, 2011. CTBs were placed on the west and north upland portions of the LaBarge property to delineate the stockpile management areas. Material stockpiling began on February 1, 2011. An access road from the rock stockpile area to the dock was installed using 2 to 3 inch diameter crushed concrete. The road was approximately 6 inches thick and 150 feet long, and required the installation of a culvert and a total of 185 tons of aggregate to complete construction. A water truck was used, as needed, at the LaBarge property for dust suppression along the haul road.

Due to the distance from the stockpile area to the edge of the San Jacinto River (approximately 150 feet with a well-vegetated grassy slope between the stockpile area and the dock area), a silt fence was not installed at the stockpile area. Instead, a determination was made to observe the surface water runoff resulting from a significant rain event to assess whether controls needed to be installed. On March 18, 2011, during a significant rain event, USA did not observe any issues resulting from surface water runoff. For the duration of the construction and stockpiling activities, USA and Anchor QEA continued to monitor whether silt fencing or other BMPs to address surface water runoff were needed around the stockpile areas. No instances in which such measures were needed were observed.

5.1.2 Transport Barge Assembly

The transport barge was assembled out of individual sectional barges. The sectional barges were delivered by truck to the LaBarge property beginning on February 1, 2011, and were offloaded into the River using a crane. Once in the water, each of the sectional barges was connected using steel pins to construct the 110 foot long transport barge, which was used for the delivery of armor stone and other materials to the SJRWP (e.g., turbidity curtain). A crane and long-reach excavator was used to manipulate the barge sections in place during assembly.

An engine and two propellers were installed at the rear of the barge. Additionally, a 2 foot high steel rail was welded to the port side of the barge to prevent aggregate spillage during loading and unloading operations. The starboard side was equipped with a 6 inch high steel rail. Steel plates and hooks were welded to the deck to provide flooring atop the barge. Additionally, cleats were welded strategically around the barge to provide adequate tie-off locations. Spuds were attached to the barge's exterior to prevent drifting and provide stability during loading and unloading operations. The final assembly item, a weather shed, was affixed to the top of the transport barge. Assembly of the barge was completed on February 14, 2011.

5.1.3 Perimeter Buoys

A series of 29 buoys were installed along the perimeter of the Eastern Cell to warn passing vessels to keep out of the SJRWP area. Two types of buoys were deployed at the Site: 25 ball float buoys and four regulatory buoys. The ball float buoys were 18-inch diameter spherical orange ball float buoys, and were arranged in five sets of five buoys, with each buoy spaced approximately 30 feet apart. The regulatory buoys measured 4 feet tall and were marked with text and symbols indicating that the SJRWP was a no access area. The four regulatory buoys were placed between the five sets of five ball float buoys.

Concrete anchors for the buoy system were cast off-site, and a dry assembly of the buoy system was completed. USA modified a barge vessel with a steel frame and winch to aid in buoy placement and retrieval operations. USA used a rubber-tired fork lift to load the pre-assembled buoys and anchors onto the modified barge vessel and used the winch to lower the concrete anchors into position. Steel cables connected the buoys to the concrete anchor and to the adjacent buoys. The complete buoy system was installed by December 22, 2010.

5.1.4 Turbidity Curtain

As outlined in the RAWP (Section 4.2.2) and described in the Contractor's EPP, a turbidity curtain was installed around the water-based armored cap placement activities. It was delivered to the LaBarge property on February 11, 2011, and transported via barge to the TCRA Site. The turbidity curtain was installed approximately 40 feet outside the boundary of the armored cap placement area to provide an egress route for a support boat in the event of an emergency. The buoy system was moved accordingly to a distance 40 feet outside the armor rock placement area to account for the location of the turbidity curtain. Installation of the turbidity curtain and repositioning the buoy system around the Eastern Cell was completed on February 15 and 16, 2011.

The effects of tidal set and drift in this area of the River became apparent soon after deployment. The turbidity curtain regularly shifted into and out of the work areas with the incoming and outgoing tides. To combat the movement of the turbidity curtain, additional anchors were added to the turbidity curtain system to minimize migration from the established 40 foot offset outside of the Eastern Cell.

At the start of work on February 28, 2011, a breach in the southeast portion of the turbidity curtain was observed. Armor rock placement was postponed until this section was repaired. Once repaired, additional anchors were added in this section. On March 1, 2011, two sections of the turbidity curtain were observed to be sagging 6 to 12 inches below the water surface. The CQAO mobilized by work boat to the affected portion of the turbidity curtain with members of the USA crew and inspected the turbidity curtain. The curtain was intact at both locations, but the fabric around the floating boom had torn away from the chain of the turbidity curtain, which resulted in a 10 foot foam section tearing away from the boom. Since the curtain was still intact, the CQAO permitted the Contractor to resume rock placement operations; however, repairs on the curtain were initiated immediately, and included the installation of additional buoys at the sagging locations. The intent of the buoys was to provide flotation for the curtain and visually demarcate the affected portion of the turbidity curtain at this location.

Because the turbidity curtain regularly shifted into and out of the work areas with the incoming and outgoing tides, the turbidity curtain system needed to be repositioned on a regular basis to reduce interference with armored cap placement operations. Although the turbidity curtain remained functional for the duration of the project (with the exception of the postponement of rock placement on February 28, 2011, to repair a breach to the curtain), turbidity curtain management was required throughout the duration of in-water construction activities. Further discussion on means and methods used to maintain the turbidity curtain and lessons learned are included in Section 11.5 – Turbidity Curtain Issues.

5.2 Health & Safety

All personnel at the TCRA Site participated in morning tailgate H&S meetings. The Shirley & Sons crew also held a daily tailgate meeting at the LaBarge property for water-based construction activities. The intent of these meetings was to inform all workers of the risks and potential safety hazards associated with their work activities. USA employees and subcontractors operating water-side during the TCRA construction were provided with U.S. Coast Guard-approved personal flotation devices (PFDs). Additional means (e.g., ring buoys and ladders) were provided on the vessels, per the CHASP, to provide for safe working conditions on the water.

As mentioned above in Section 4 – Land-based Construction Activities, USA established the Exclusion Zone (described in Section 4) and Restricted Zone via a memorandum dated February 14, 2011. The Restricted Zone included the remaining portion of the TCRA Site not included in the Exclusion Zone (i.e., ground surface elevations below -2 feet NAVD 88) extending to the outer perimeter of the armored cap. Construction operations in this area consisted of water-side armored cap material placement and bathymetric surveying. Typical water depths in the Restricted Zone were greater than 3.5 feet and tidally influenced. No specific HAZWOPER certifications were required for workers operating in this zone. Level D PPE, including use of PFDs, was required for construction operations being conducted in this zone.

5.3 Geotextile Placement

Subaqueous geotextile placement in the Eastern Cell required specialized means and methods to ensure that deployment could proceed expeditiously and that the final coverage met the specified tolerance.

As described in the Construction Work Plan (CWP) submitted to Respondents by USA on February 3, 2011, and provided to USEPA on February 4, 2011, two panels of geotextile were joined with a factory-produced prayer seam. Standard geotextile panels measured 300 feet long by 15 feet wide. The overlap between each of the combined panels was a minimum of 1 foot; therefore, geotextile panels delivered to the LaBarge property measured 300 feet long by 29 feet wide. Delivery of the panels began on February 15, 2011. Also specified in the CWP was the use of anchors for geotextile deployment. Cylindrical concrete anchors were cast and delivered to the TCRA Site on February 10, 2011. These anchors were used during deployment to minimize the influence of the River current, while placing the individual geotextile panels. Consecutive geotextile panels were overlapped by a minimum of 3 feet in the field, as needed, prior to placement of rock.

A geotextile deployment barge was delivered to the LaBarge property on February 11, 2011. The barge was equipped with a spindle, which was set approximately 3 feet above the deck height and parallel to the barge's long-axis (i.e., bow to stern).

Initially the geotextile was wrapped around the spindle at the LaBarge dock facility prior to mobilizing to the TCRA Site; however, shortly after placement began on February 17, 2011, it was determined that deploying the geotextile panels from a folded position, on the barge deck was more effective. Additionally, the original geotextile placement method deployed the entire 300 foot length of a geotextile panel using the cylindrical concrete anchors to weigh the geotextile down onto the sediment surface. The crew learned that the concrete anchors were insufficient by themselves, to consistently hold the geotextile in place with the River flow rates encountered in the Eastern Cell. Therefore, the placement method was adjusted from fully installing a single geotextile panel prior to rock placement to deploying the geotextile directly ahead of the armor rock placement. The geotextile barge was placed alongside the rock placement barge and moved from bow to stern manually using crew members and a jon boat. Crew members would deploy approximately 10 to 15 feet of geotextile, and the excavator operator would immediately place rock onto the deployed geotextile to provide weight to hold the geotextile in place. Further discussion on means and methods used to deploy geotextile in the Eastern Cell and lessons learned are included in Section 11.4 – Geotextile Deployment.

The geotextile panels placed in the Eastern Cell are depicted on Figure 5-1.

5.4 Armored Cap Placement

Water-based armored cap installation covered the Northwestern Area and the majority of the Eastern Cell of the SJRWP. In addition to the transport and geotextile barges described in the previous sections, a rock placement barge, equipped with a Komatsu long-reach excavator, was utilized for water-based construction operations. To assist positioning of the barges in place prior to placing armored cap material, a tug boat (the Jim Dandy) was used by Shirley & Sons as a tender.

Pre-construction surveys of the subaqueous armored cap areas were performed by Hydrographic Consultants, Inc. This bathymetric survey was completed on February 15 and 21, 2011. Water-based armored cap installation began by loading the material transport barge via excavators at the LaBarge dock facility. The armor rock was then brought to the TCRA Site and positioned alongside the material placement barge. Armor rock was unloaded by the long-reach excavator and placed atop the geotextile filter fabric.

One main consideration when placing the armor rock was the drop height. Increases in drop height of the armor rock material had the potential to affect the integrity of the geotextile filter fabric. Anchor QEA and USA communicated during the project regarding adjustments in the drop height used for subaqueous armored cap installation. It was decided that the drop height be at or near the water surface for all rock placement.

Installation of the armored cap via water-based placement was initiated on February 17, 2011. The initial placement was completed on May 19, 2011. An armored cap survey using bathymetric survey data and manual probing of the Armor Cap identified areas where additional armored cap placement was needed. The additional armored cap placement was completed from June 27 to July 11, 2011.

5.4.1 Armored Cap Loading and Transport

All armored cap material installed using water-based equipment were transported to the SJRWP from the LaBarge property. Armored cap materials were transported to the dock area of the LaBarge property using front-end loaders, then loaded onto the transport barge using an excavator. The transport barge had a capacity of approximately 300 tons. Shirley &

Sons crew would monitor the amount of rock placed on the transport barge using two independent measurements. First, the crew would count the number of bucket loads of rock (with a fixed volume and known weight-to-volume ratio) placed onto the transport barge. Secondly, the crew would measure the draft of the transport barge in the water before and after loading, and calculate the weight of the rock by the amount of water displaced by loading the barge.

After the transport barge was loaded, the barge delivered the armored cap materials to the SJRWP. The barge was positioned next to the armored cap placement barge, which remained at the SJRWP area. After the excavator on the armored cap placement barge emptied the transport barge by placing the materials into the armored cap, the transport barge returned to the LaBarge property to receive another load of armored cap material.

5.4.2 Eastern Cell

Construction of the armored cap in the Eastern Cell via water-based operations used Armor Cap A, C, and D. As described above, the geotextile was deployed ahead of the armor rock placement in the Eastern Cell. The armor rock material was used to weigh down the geotextile. Installation of Armor Cap D began on February 17, 2011, and continued until March 18, 2011. Shirley & Sons began placement of Armor Cap C on March 17, 2011, and continued such placement until March 24, 2011.

As discussed further in Section 11.2 - Barge-Based Placement of Armored Cap in the Eastern Cell, the placement approach in the Eastern Cell was modified to utilize barge-based placement operations for all areas accessible by barge, due to sediment heave caused by land-based access described in Section 4.9.1 – Eastern Cell.

Although the barge-based placement operations were successful in placing the armored cap in near-shore portions of the Eastern Cell, production rate was limited due to tides. Additionally, owing to the shallow conditions, the material transport barge could not access certain areas while fully loaded. To compensate, the transport barge loads were reduced from 300 tons to 150 or 200 tons, which allowed for access to shallower-water portions of the Eastern Cell. To access the shallow-water portions of the Eastern Cell with the material transport barge, the subcontractor used several methods including towing using a combination of the Jim Dandy tug boat, the jon boat, a tow rope attached to the excavator on the material placement barge and positioning a long-reach excavator on the material transport barge and using the excavator bucket as a rudder or paddle outside the cap limits as needed. These methods allowed Shirley & Sons to access the near-shore areas during favorable tide conditions and complete the armored cap placement in the Eastern Cell.

5.4.3 Northwestern Area

Prior to initiating armored cap installation in the Northwestern Area, the spuds on the rock placement barge were lengthened. This area of the Site is substantially deeper than the Eastern Cell, and accordingly, an additional 10 feet were added to the spuds on the barge. The modifications began on March 24, 2011, and were completed by March 25, 2011.

Additional turbidity curtain was added around the Northwestern Area, approximately 40 feet outside the boundary of the armored cap placement area, prior to construction; installation was coordinated with the modifications to the rock placement barge and was also completed on March 25, 2011.

As described in the RAWP, the Northwestern Area did not require an underlayer of geotextile fabric. Armor Cap A was used in the Northwestern Area and it was placed directly atop the River sediments. Delivery of Armor Cap A to the LaBarge property began on March 17, 2011, and placement began on March 28, 2011.

Beginning on March 28, 2011, the rock placement in the Northwestern Area and subsequent rock placement in the Eastern Cell was tracked using a TOPCON unit that collected real-time kinematic (RTK) digital global positioning system (DGPS) bucket position data. These data were then used to develop placement coverage maps displaying cap installation progress.

5.5 Water Quality Monitoring

Water quality monitoring was performed as described in the Water Quality Monitoring Plan (WQMP) (Appendix F to the RAWP) to evaluate potential impacts on water quality at the TCRA Site during the TCRA construction.

Quantitative and qualitative water quality monitoring was performed during in-water work at the TCRA Site. Two quantitative water quality monitoring events were conducted by Anchor QEA during the TCRA construction, and a total of 85 discrete turbidity measurements were collected as part of the quantative monitoring events. No exceedances were detected to trigger the implementation of additional BMPs or an interruption of construction activities. A summary of the quantitative monitoring events is provided in a technical memorandum in Appendix J of this document.

Stations for the quantitative monitoring were established as part of the WQMP. A background and mixing zone location were both monitored for turbidity to establish a baseline turbidity level to compare to the TCRA monitoring locations.

The first turbidity monitoring event, which lasted from February 17, 2011 to February 23, 2011, was performed to fulfill the water quality requirements described in the RAWP. As outlined by the WQMP, the purpose of the monitoring was to detect changes in water quality associated with the implementation of TCRA that could result in unacceptable exposure to human and ecological receptors or deposition of contaminated sediment outside the project area (Anchor QEA 2010a). Based on the results of the water quality monitoring, no exceedances were detected to trigger the implementation of additional BMPs or an interruption of construction activities.

At the request of the USEPA, Anchor QEA performed additional water quality monitoring during the in-water TCRA construction operations. The monitoring event lasted two days, from March 22 and 23, 2011. The intent of the second monitoring event was to monitor the conditions during the tugboat and barge movement around the TCRA Site. The concern was that the propeller wash of these vessels could increase turbidity, and potentially adversely affect the water quality of the Site and surrounding waters. As with the first monitoring event, no exceedances were detected to trigger the implementation of additional BMPs or an interruption of construction activities.

In addition to the quantitative monitoring events, qualitative monitoring via visual assessments of the surrounding water conditions was conducted by Anchor QEA on a daily basis during the in-water construction. These observations were recorded in the Daily

Construction Reports prepared by Anchor QEA; visible turbidity plumes were not observed outside the turbidity curtain during water-based placement activities.

5.6 Progress Surveys

Progress surveys to evaluate in-place cap thickness were initially conducted by Land Surveying, Inc. These surveys were conducted from February 18, 2011 to February 24, 2011, in the Eastern Cell. On March 7, 2011, USA transitioned responsibilities for surveying to another subcontractor, CRA. These progress surveys continued, as needed, to identify those areas of the armored cap not meeting the required minimum thicknesses. Following the completion of the initial water-based rock placement on May 19, 2011, CRA completed a bathymetric survey of the entire Eastern Cell and Northwestern Area on May 23 and 24, 2011.

In addition to the progress survey data, CRA installed five settlement plates in the Eastern Cell at the locations shown on Figure 5-2. The settlement plates were constructed of hollow 2 inch diameter steel pipe with a flat steel plate welded to one end of the pipe. The steel plate was set on the surface of the sediment, with the hollow pipe extending above the water surface. The settlement plates allowed the surveyor to measure the elevation of the steel plate by lowering a survey rod through the hollow pipe to the top of the steel plate. The surveyor collected settlement plate elevation data before and after placement of the armored cap, to monitor settlement associated with installation of the armored cap in the Eastern Cell.

These plates were installed by CRA beginning on April 27, 2011. Survey data collected from the settlement plates is provided in Table 5-1; these data indicate that the weight of the armored cap caused cumulative settlement of 0.06 to 0.49 feet in the Eastern Cell.

Table 5-1

Cumulative Settlement (feet)

Station	Date of Installation	April 29, 2011	May 5, 2011	May 10, 2011	May 13, 2011	May 18, 2011	July 12, 2011
1	April 27, 2011	0.03	NM	NM	NM	0.21	0.16
2	April 29, 2011	NM	NM	0.06	NM	0.10	0.23
3	May 5, 2011		0.11	NM	NM	0.43	0.49
4	May 10, 2011			0.08	NM	0.19	0.23
5	May 13, 2011				0.03	0.05	0.06

Notes:

NM = Not Measured

5.7 Demobilization

On July 8, 2011, prior to demobilizing from the LaBarge property, repairs were made to the gravel parking surface that was used as a rock stockpile area. Demobilization of the equipment and facility used for the TCRA began on July 12, 2011, with the breakdown of equipment used for barge-based rock placement. The removal of the turbidity curtain began on July 14, 2011. Once detached from the anchors, the turbidity curtain was transported via work boat to a land-based long-reach excavator that placed the turbidity curtain into a roll-off box for off-site disposal. Turbidity curtain removal was completed on July 15, 2011, and the roll-off box was hauled off-site. Demobilization from the LaBarge property of all barge-based construction equipment was completed on July 15, 2011.

6 CHRONOLOGY OF SIGNIFICANT CONSTRUCTION EVENTS

This section provides a chronology of significant construction events. The chronology is depicted in Figure 6-1 as compiled from the TCRA Daily and Weekly Progress Reports written by Anchor QEA. The information provided in Figure 6-1 outlines the events leading up to and during the TCRA construction. For a detailed account of TCRA construction events, the TCRA Daily and Weekly Progress Reports are provided in Appendix C of this document.

7 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY ASSURANCE

Quality control for implementation of the performance standards was the responsibility of the Contractor. As part of the Contractor submittals, USA prepared a Construction Quality Control (CQC) Plan and submitted it to the Respondents as a draft on February 8, 2011 and as a final plan on February 22, 2011. The final CQC Plan was forwarded to USEPA on February 23, 2011. The CQC Plan outlines the means and methods USA used to ensure that all components of the TCRA were constructed in accordance with the Project Specifications.

Additionally, on behalf of the Respondents, Anchor QEA performed QA assessments of both the documentation and implementation of the TCRA construction. Anchor QEA's Construction Quality Assurance Plan (CQAP) is included in Appendix F of the RAWP (Anchor QEA 2011). This document established the QA measures and inspection and verification activities. The designated on-site Construction Quality Assurance Officer (CQAO) was responsible for enforcing the CQAP for the duration of the TCRA construction.

7.1 Access Road

As part of Exhibit A of the TxDOT Agreement, the general alignment and typical cross section of the access road were both established. Construction of the access road included rough grading, geotextile deployment, CCRB installation, and final grading. Per the Agreement, the road alignment was surveyed prior to construction. The construction activities were field verified for accuracy. Adjustments in the road thickness were made, as necessary, to accommodate the culvert installation described in Section 4.1.3.1 – Road Construction. These adjustments to the established design were approved by the CQAO prior to implementation.

7.1.1 Debris Removal in TxDOT ROW

As discussed in Section 2.4.1.1 – Debris Removal, the TxDOT Agreement required removal of debris originating from under the I-10 Bridge. Specific means and methods were not established as part of the TxDOT Agreement; however, in accordance with Section 5.7.2 of the CQC Plan, documentation of all materials sent for final disposal (including the debris) is being retained by USA and Anchor QEA. Additionally, as established in the CQAP (Section 5.2.1 – Contractor's Daily Quality Control Report), debris disposal was recorded in each

Daily Construction Report prepared by the CQAO. Debris processing (i.e., quartering tires) was performed per the requirements established by the Coastal Plains RDF. Non-hazardous waste manifests were completed for each load of debris transported to Coastal Plains RDF; the manifests are included in Appendix K.

7.1.2 Guardrail Installation

As discussed in Section 4.1.3.2 – Guardrail Installation, a guardrail was installed along the south side of the access road. The general alignment was established as part of Exhibit A of the TxDOT Agreement; the actual alignment was field verified by a pre-construction survey of the TxDOT ROW. The survey was performed in accordance with USA's CQC Plan. The guardrail material and construction adhered to the TxDOT Specifications Manual Item 540 – Metal Beam Guard Fence. A USA subcontractor, National Fence, was responsible for the installation; the CQAO observed fence installation for general conformance with the specifications.

Per the Agreement with TxDOT, the soils excavated for the guardrail post installation were disposed in a landfill. A composite sample of these soils was tested via the toxicity characteristic leachate procedure (TCLP), for lead, in accordance with waste characterization requested by Coastal Plains RDF. Results from the TCLP tests were received the week of April 4, 2011. All soils met the approval of the Coastal Plains RDF. TxDOT representatives visited the TxDOT ROW on August 3, 2011, to observe the guardrail following installation. During the site visit, TxDOT representatives indicated verbally that the installation of the guardrail was satisfactory.

7.2 Dust Control (TxDOT ROW and LaBarge Property)

Temporary access roads were established at the SJRWP and the LaBarge property for TCRA construction activities. As required by Exhibit B of the TxDOT Agreement, and as described in the RAWP, dust control measures were implemented along the TxDOT ROW access road. These measures were carried out in accordance with TxDOT Specifications Manual Item 204 – Sprinkling through the use of a water tanker truck. The haul road at the LaBarge property received similar treatment for dust mitigation. USA was the responsible on-site coordinator for the tanker trucks and dictated their operational frequency. The CQAO requested additional sprinkling on an as-needed basis.

7.3 Clearing and Grubbing

As described in Section 4.4 – Western Cell Clearing and Grubbing, the method used for processing stumps in the Western Cell was revised based on an RFI sent by USA to Anchor QEA. The revised method called for stumps to be processed using an excavator with a bucket and hydraulic thumb attachment. Anchor QEA agreed that this alternative method would meet the intent of the design set forth in the RAWP. USA verified through on-site observation that the processed vegetation was chopped into pieces not exceeding 18 inches in length. The processed vegetation was matted into the surface soils in low-lying areas of the Western Cell.

All above-ground vegetation removed from the Western Cell was stockpiled atop plastic sheeting to protect it from potential contact with paper mill sludge. As stockpiled above-ground vegetation was loaded into roll-off boxes for off-site transport, it was visually inspected for paper mill sludge (light gray, fine-grained, and fibrous in appearance) and photographed by the CQAO (Appendix F). If paper mill sludge was observed in any portion of the vegetation, it was segregated and remained on-site in the Western Cell. The above-ground vegetation observed to be free of paper mill sludge was loaded into roll-off boxes for off-site disposal at the Atascocita RDF.

7.4 Site Grading to Design

7.4.1 Stabilization

To facilitate access over soft soil conditions in the low-lying areas of the Western Cell, USA presented an approach for stabilizing these soils using Portland cement. USA performed bench scale tests to assess the type and quantity of stabilizing reagent. The results of the tests are presented in Appendix G. USA's geotechnical engineer calculated the results and provided guidance for selecting the admixture ratio.

In order to ensure that the compressive strength of the stabilized soils met the criteria set forth by their geotechnical engineer, USA performed the following QC measures:

- Monitored the weight of each Portland cement delivery,
- Monitored the mixing penetration depth of the excavator bucket (qualitative monitoring only), and
- Collected and tested a representative sample from each segment to measure the compressive strength. Tests were performed using a pocket penetrometer.

7.4.2 Surface Preparation

USA's approach for construction of the Western Cell cap included establishment of a smooth surface atop the stabilized surface soils. This layer, approximately 6 inches thick on average, was constructed with CCRB material as described in Section 4.6 – Western Cell Surface Grading. USA used the same means and methods for the surface preparation as were used for the access road construction. To maintain a smooth surface during surface preparation activities, low ground pressure equipment (i.e., Morooka trucks and skidsteers) were used to deliver material and perform grading. The CQAO observed the installation of the CCRB material.

7.5 Geotextile Coverage

7.5.1 Eastern Cell

Eastern Cell geotextile deployment was performed using both land- and water-based means as previously described. Land-side placement was performed by CRA surveyors and USA crew members. The survey crew provided position locations for the overlapping portions of adjacent geotextile panels. The minimum overlap used was 3 feet. This distance was physically marked off using painted stakes/rebar. The USA crew members then deployed the geotextile panels, using the markers so that the minimum overlap was achieved. The land-based long-reach excavator was used, as needed, for assistance during deployment.

Water-based geotextile placement in the Eastern Cell was performed by Shirley & Sons crew members. Each panel of geotextile was left uncovered with rock for the 3 feet nearest the armored cap placement barge and checked using stakes/rebar. The adjacent panel was then placed over this uncovered section of geotextile to provide a 3 foot overlap. Shirley & Sons crew members recorded the position of the geotextile panels during deployment (Figure 5-1).

The CQAO observed geotextile placement operations and reviewed several progress figures similar to Figure 5-1 that displayed the geotextile deployment.

7.5.2 Western Cell

The Western Cell cap included the installation of two geotextile layers. Geotextile deployment was performed using the means and methods outlined in Section 4.7 – Geotextile Installation. The overlap between adjacent panels was field verified through visual observation of the USA and Envirocon crew members. A 3 foot overlap was required for panels not sewn together; however, it was determined that the geotextile panels would be joined together in the field. A "Leister" or heat welded seam was created along each edge using a Leister heat gun or similar device, and as a result the minimum overlap was reduced to 1 foot. The CQAO observed the heated welded seams during geotextile deployment and noted that overlap between adjacent panels of geotextile was achieved.

7.6 Geomembrane Coverage

The Western Cell cap also included the LLDPE geomembrane layer. Geomembrane panels were joined together using a double seam type fusion weld. These welds were pressure tested after installation to ensure that the seal was complete. All portions of the geomembrane that were tested received an extrusion welded patch, and each patch was then tested for integrity using a vacuum box. A summary of the panel layout, including a figure, are provided in Appendix H. A figure depicting the area covered by the geomembrane is included as Figure 4-2.

7.7 Import Material Testing

Analytical testing of the armor materials delivered for the TCRA was performed. The requisite criteria for each analyte are given in the Technical Specifications. The Contractor was required to submit analytical testing results for approval by Anchor QEA. Grain size analyses were also performed to demonstrate that armored cap materials met the requisite specifications. Materials testing and other analytical results are provided in Appendix L.

7.8 Armored Cap Thickness and Extent

7.8.1 Eastern Cell

USA's QC procedures to measure the thickness and extent of the armored cap during and after placement in the Eastern Cell included the following:

- Placement of markers in the water (e.g., rebar poles, buoys) to mark the extent of rock placement and the transition points between different types of rock.
- Calculation of the area necessary to place a known quantity of rock—300 tons, or one full load on the aggregate transport barge—to the required thickness, and placing the 300 tons of rock within the calculated area.
- Use of a RTK-DGPS to track the extent of rock placement.
- Manual probing of water depths before and after rock placement to determine the thickness of the placed rock.
- Visual confirmation of the thickness and extent of placed rock in upland and shallow-water portions of the Eastern Cell that were completed using land-based equipment.
- Completion of progress surveys during construction to measure thickness and extent.
- Completion of final bathymetric and topographic surveys following armored cap placement.
- Manual probing of armored cap thickness.

Respondents' QA procedures that were employed during construction to evaluate the extent and thickness of the armored cap placement included the following:

- Review of Contractor submittals, including the CWP, EPP, CQC Plan, CHASP, SSP, and material gradation and chemistry tests.
- Visual observation of the rock placement techniques, including:
    - Observing the use of markers to place the armored cap material in designated areas,
    - Monitoring the drop height of the excavator placing armored cap material, and
    - Observing that the armored cap materials placed on slopes were placed from the toe of slope up toward the crest.
- Review of the RTK-DGPS data to evaluate the extent of armored cap placement.
- Review of the progress and final survey data to evaluate the extent and thickness of armored cap placement; survey data was collected by a combination of topographic

survey data in shallow-water areas and single-beam, dual-frequency echo-sounder in areas with sufficient water depth to be accessed by boat.

- Visual observation of the thickness and extent of placed rock in upland and shallow-water portions of the Eastern Cell that were completed using land-based equipment.
- Observation of manual probing conducted by the Contractor to measure the thickness of armored cap placement; manual probing was completed on a 30 foot by 30 foot grid pattern.

7.8.2 Western Cell

USA's QC procedures to measure the thickness and extent of the armored cap during and after placement in the Western Cell included the following:

- A survey was completed prior to armored cap placement to mark the areas receiving Armor Cap B/C and D rock; the areas were established by spray painting demarcation lines onto the surface of the 16-oz geotextile in the Western Cell.
- A spotter was positioned ahead of the operators placing the armored cap; the spotter used a stake marked with the appropriate cap thickness to assist the operator with observing and placing the requisite thickness of armor rock placement.
- A progress topographic survey was completed following armored cap placement in the Western Cell in conjunction with manual probing of the armored cap thickness on a 30 foot by 30 foot grid pattern.
- A final topographic and manual probing survey was completed following armored cap placement.

Respondents' QA procedures that were employed during construction to evaluate the extent and thickness of the armored cap placement included the following:

- Review of Contractor submittals, including the CWP, EPP, CQC Plan, CHASP, SSP, and material gradation and chemistry tests.
- Visual observation of the rock placement techniques and the thickness being placed as the work was in progress.
- Observation of the manual probing conducted by the surveyor to measure the thickness of armored cap placement; manual probing was completed on a 30 foot by 30 foot grid pattern.

- Review of the manual probing survey data collected to measure the extent and thickness of armored cap placement.

7.9 Procedures to Minimize Release of Suspended Sediment

7.9.1 Cap Placement Procedures

Respondents' QA procedures that were employed during water-based cap placement included visual observation of the cap placement from upland portions of the TCRA Site. Items of interest during visual observation included the following:

- Monitoring the drop height of the rock and providing periodic reminders to minimize the drop height, to minimize disturbance of the sediment surface located beneath the geotextile.
- Observing the deployment of geotextile in advance of the armored cap placement.
- Observation of the operator's methods in areas with a sloped sediment surface, especially the Northwestern Area, to confirm that armored cap materials were placed beginning at the toe of the slope and continuing up toward the crest.

7.9.2 Turbidity Curtain

The turbidity curtain was visually inspected from the upland portions of the Site on a daily basis to observe that it remained in place around the water-based rock placement operations. If a breach in the turbidity curtain was observed or suspected, it was inspected by USA personnel and the CQAO in a work boat. In addition, visual observations were made throughout water-based rock placement activities for signs of turbidity outside the curtain, which would potentially indicate damage to the curtain; visible turbidity plumes were not observed outside the turbidity curtain.

7.9.3 Water Quality Monitoring

7.9.3.1 Quantitative Monitoring

Two quantitative water quality monitoring events were carried out during the TCRA construction. These are discussed fully in the memorandum provided in Appendix J. The WQMP provided as Appendix F of the RAWP established the monitoring locations and protocol used during these events. Anchor QEA was responsible for both the monitoring and analysis of results. No exceedances were detected that triggered any suspension or alteration in the TCRA in-water construction activities.

7.9.3.2 Visual Monitoring

Visual monitoring was performed by Anchor QEA for the duration of the in-water construction activities. During rock installation, a turbidity plume emanating from the placement area was observed by the CQAO. No instances occurred where the turbidity plume was observed to extend beyond the turbidity curtain system.

7.10 USEPA Oversight Activities

USEPA or their designated representative (Dynamac, a Superfund Technical Assessment & Response Team [START] Contractor working on behalf of USEPA) was on-site during TCRA construction to monitor progress. Weekly meetings were held including the Respondents, Anchor QEA, USA, and USEPA to discuss completed and upcoming work items.

8 FINAL INSPECTIONS AND CERTIFICATIONS

8.1 Eastern Cell and Northwestern Area

8.1.1 Pre-Final Survey

Following the initial placement of the armored cap in the Eastern Cell and Northwestern Area, CRA completed a bathymetric survey of the entire Eastern Cell and Northwestern Area. The data produced by the bathymetric survey proved inconclusive, with post-construction elevations up to several feet higher or lower than the pre-construction bathymetric survey in some areas with no discernable trend in these differences. Suspected causes for the inconclusive survey data are discussed in Section 11.6 – Armored Cap Bathymetry.

Because the bathymetric survey data was inconclusive, a manual probing survey was performed to measure the thickness of the armored cap. The manual probing was completed by the surveyor with assistance from USA, Shirley & Sons, and under observation by Anchor QEA personnel.

For each manual probing location, the surveyor collected a top-of-rock elevation. Then, a crew member used a section of rebar to penetrate through the aggregate layer until the underlying geotextile was reached (in the Northwestern Area, the rebar was pushed through the aggregate layer until resistance to probing was minimal, indicating that the rebar had penetrated through the aggregate to the softer underlying sediments). Once the bottom of the aggregate was identified, the depth of the rebar was noted, and the rebar was retrieved and placed on the top of the aggregate, and the depth of the rebar was noted again. The thickness of the aggregate, defined as the difference between the rebar depth from the bottom of the aggregate and the top of the aggregate, was recorded by the surveyor along with the GPS coordinates of the probed location.

The Eastern Cell and Northwestern Area were probed on a 30 foot by 30 foot grid pattern; if a location indicated insufficient thickness of the cap, additional probing locations were collected 15 feet from this location to delineate the limits of the thin location. Shallow-water areas were probed by a work crew walking on the armored cap in waders, and areas accessible by boat were probed by a work crew probing from Shirley & Sons floating dock.

8.1.2 Augmenting Areas with Less Than Specified Cap Thickness

Based on the results of the manual probing, Shirley & Sons returned to the locations with insufficient thickness, and placed additional rock at those locations. Because the existing armored cap reduced the amount of available water draft in the Eastern Cell, the transport barge was loaded with 50 to 100 tons of rock, rather than a full load of 300 tons, to access shallow water areas. Due to limited water depth, some portions of the Eastern Cell could not be reached with the barge-mounted excavator that was used for water-based rock placement; to access these locations, Shirley & Sons used a mini-excavator placed on a floating dock with approximately 10 to 20 tons of rock to complete additional rock placement.

Shirley & Sons placed additional rock at the locations and to the limits delineated by the manual probing survey. The surveyor remained with the Shirley & Sons crew and probed the area immediately following rock placement to measure whether the target thickness had been obtained. After the surveyor measured adequate thickness of rock, Shirley & Sons moved to the next location. The armored cap locations identified as thin by the pre-final survey were augmented in this manner until all locations reached the target thickness on July 11, 2011.

8.1.3 Final Survey

As mentioned in the previous section, the surveyor remained with the Shirley & Sons crew to measure the armored cap thickness immediately following augmentation at each location. The final manual probing survey in the Eastern Cell and Northwestern Area was completed concurrent with the completion of rock placement operations on July 11, 2011. Results of the final manual probing survey are shown on Figure 8-1.

8.2 Western Cell

8.2.1 Pre-Final Survey

The pre-final survey in the Western Cell was completed in two stages, one following installation of Armor Cap B/C and the second following installation of Armor Cap D. The pre-final survey was completed using a combination of topographic surveying and manual probing. The manual probing was similar to the probing completed for the Eastern Cell: using a piece of rebar to probe through the aggregate to the underlying geotextile and measuring the difference between the top of the aggregate and the base of the cap at the geotextile surface.

USA and CRA crews completed the pre-final survey on the installed Armor Cap B/C from June 21 to 23, 2011. The manual probing identified five locations that did not achieve the required minimum 12 inch thickness of Armor Cap B/C. Additional surveying was completed at 15 foot intervals around these five locations and determined that placing additional cover over a 30 foot diameter area would achieve the necessary armored cap thickness.

Following installation of Armor Cap D, a manual probing survey was completed for these portions of the Western Cell on July 8 and 12, 2011. All manual probing results for Armor Cap D in the Western Cell met the target armored cap thickness.

8.2.2 Augmenting Areas of Insufficient Cap Thickness

As mentioned above in Section 4.9 – Armored Cap Placement, five locations in the Western Cell required additional rock placement to achieve the requisite 1-foot minimum Armor Cap B/C cover thickness. On June 24, 2011, USA placed additional Armor Cap B/C at these five locations using a long-reach excavator; CRA surveyed the armored cap at these five locations immediately following placement of additional cover and confirmed that the required 12 inch minimum cover had been achieved at each location.

8.2.3 Survey

As mentioned in the previous section, the surveyor remained with the USA crew to measure the armored cap thickness immediately following augmentation at the five locations in the Western Cell identified by the pre-final survey. The final manual probing survey following augmentation was combined with the pre-final survey data in areas that did not require augmentation to generate the final manual probing survey for the Western Cell. Results of the final manual probing survey are shown on Figure 8-1.

8.3 Health & Safety

No final inspections or certifications were required relating to health and safety issues. No injuries occurred during TCRA construction activities.

8.4 Institutional and Engineering Controls

The institutional and engineering controls at the TCRA Site following the completion of TCRA construction consist of perimeter fencing and warning signs; these controls were initially put in place during construction and will remain in place. On August 1, 2011, a walkthrough of the TCRA Site was performed to observe and document the condition of these controls. Roving security patrols and remotely monitored cameras that were in use during TCRA construction will not be in use after construction.

The perimeter fence is located on the west side of the San Jacinto River on the north and south sides of the I-10 Bridge and on the east side of the San Jacinto River on the south side of the I-10 Bridge. Warning signs are posted on the perimeter fence. During the site walkthrough, no breaches were observed in the fence and the warning signs were posted on the fence in their designated locations. The perimeter fence and warning signs will be monitored following construction as discussed in Section 9.

In addition to the warning signs posted on the perimeter fence, 15 warning signs are posted around the perimeter of the impoundments to be visible to passing vessels on the San Jacinto River. These warning signs are mounted on steel posts set in a 3 foot by 3 foot concrete block. During the walkthrough conducted following completion of TCRA construction, all 15 signs were posted in their designated locations.

9 OPERATIONS, MONITORING, AND MAINTENANCE

Appendix M contains an Operations, Monitoring, and Maintenance (OMM) Plan developed to monitor the conditions of the TCRA. The OMM Plan was developed in accordance with Task 5 of the SOW of the AOC and identifies the continuing obligations, including monitoring and maintenance. The components of the OMM Plan are briefly described in the following subsections. Respondents' ability to implement the OMM Plan is dependent upon continuing access to the TxDOT ROW.

9.1 Post-Construction Monitoring Frequency

As required by USEPA, and described in the OMM Plan (Appendix M) inspections of the fencing, signage, and the protective armored cap will be performed quarterly for the first two years following completion of the TCRA construction, semi-annually from years three to five, and annually starting at year six. In addition, an inspection of the armored cap will be performed following the first 25-year flow event, and inspections of the armored cap will be performed after all 100-year flow events. An automated process to monitor whether a 25-or 100-year flow event has occurred is in development, and is described in the OMM Plan.

9.2 Post-Construction Inspection Elements

As described by the OMM Plan, the following TCRA elements will be inspected as part of each event:

- Visual inspection of the security fence and signage surrounding the TCRA Site.
- Visual inspection of the armored cap located above the water surface.
- Visual observation that waste materials are not being actively eroded into the River.

In addition, each inspection event will include:

- Collection of topographic survey data for the portions of the armored cap that are located above the water surface or at a water depth too shallow to access by boat and bathymetric survey data for the portions of the armored cap that are below the water surface and accessible by boat.
- Manual probing of armored cap thickness if necessary at areas identified by the topographic or hydrographic surveys as more than 6 inches lower in elevation than

the prior survey.

Chemical monitoring is planned for the San Jacinto River in the vicinity of the TCRA Site, however, USEPA is in discussions regarding whether chemical monitoring will be conducted as an RI/FS activity or a TCRA activity. Therefore, the OMM Plan (Appendix M) does not include provisions for chemical monitoring.

9.3 Post-Construction Repair Procedures

If the need for repairs is identified as part of an inspection, the repairs will be made using means and methods similar to those used for the TCRA construction. Upland repairs would be made with standard earth-moving equipment (e.g., long-reach excavators, dozers, front-end loaders, and low-ground pressure trucks). Deliveries of armored cap materials would be received along the TxDOT ROW. Subaqueous armored cap repairs would be carried out using barge-based equipment (e.g., material transport barges, barge-mounted long-reach excavators, and support boats).

9.3.1 Response Time

In the event that Respondents determine, following an inspection, that there is a deficiency in the armored cap (as defined in the OMM Plan in Appendix M), the Respondents will submit a written notice to the USEPA within one business day of making that determination. A list of criteria defining armored cap deficiencies is provided in the OMM Plan. Following USEPA's review of the notice of deficiency, a repair plan will be developed by the Respondents, and repairs will commence upon receiving USEPA approval of the proposed repair. As outlined in the OMM Plan, the Respondents will establish an on-call agreement with a local contractor to minimize the response time. Approximately 2,600 tons of natural rock (Armor Cap C and D) have been stored at a facility located approximately 10 miles away from the Site. Processed concrete (Armor Cap A and B/C) is locally available and procurement typically does not have significant lead time. If more natural rock is required for repairs than the quantity currently stockpiled, the OMM Plan provides for the use of processed concrete to complete temporary repairs until the natural rock is available for use.

9.3.2 Surveys

If applicable, following repair of any deficiency requiring repair of the armored cap, the repaired areas will be re-surveyed to establish a new baseline survey for the affected area. Survey techniques are specified in the OMM Plan.

10 CONSTRUCTION COSTS

The estimated cost for the TCRA construction is $8.78 million based on invoices received from National Fence and USA to date. Costs for engineering design, construction management, and USEPA oversight are not included in this estimate. This cost estimate is subject to change pending final approval of all Contractor invoices. A summary table of the construction costs, pending final approval of all Contractor invoices, is included in Table 10-1.

11 LESSONS LEARNED

Certain Site and project conditions required revisions to the TCRA implementation strategy. Anchor QEA and USA worked to modify the means and methods used for the TCRA as appropriate. All revisions to the design were reviewed and approved by the USEPA. Lessons learned during the TCRA construction are summarized in the following sections, and can be used for planning future work at the SJRWP.

11.1 Utility Location

TxDOT does not participate in the Texas One Call utility location system. During fence installation, a power cable leading to a traffic camera overlooking I-10 was damaged and required repair. Any future work planned on TxDOT ROWs must consider this factor, and direct contact with TxDOT must be established to locate on-site utilities.

11.2 Barge-Based Placement of Armored Cap in the Eastern Cell

Because of the soft sediments and proposed use of standard land-based equipment by USA, cost-effective construction of access points in the Eastern Cell were deemed by USA to be not feasible. USA had to modify their original plan of using access points for material placement. The access points created in the Eastern Cell for the land-based construction equipment resulted in the lateral movement of underlying soil layers, and excess armor rock material was required to create a stable access point. USA submitted a letter to the Respondents on April 12, 2011, outlining a suggested approach to address these areas via water-based equipment. A formal WDC was issued by the Respondents on April 25, 2011. In the WDC the Respondents authorized USA to utilize water-based installation methods in these areas of the Eastern Cell. The water-based construction operations resulting from the WDC were completed by May 18, 2011.

Any future planned work in the nearshore area needs to consider the weak nature of the sediments. Utilization of water based construction equipment as much as feasible is preferable; otherwise, the use of low pressure equipment where water placement is not feasible is required.

11.3 Stabilization of the Western Cell

USA's initial plan was to complete cap construction within the Western Cell utilizing equipment operating directly on the subgrade. Initial attempts to access low-lying portions of the Western Cell were difficult because the surface soil conditions were not competent to withstand the weight of equipment. An access point across one of the low-lying areas was constructed using geogrid, geotextile, and CCRB; heaving of the ground surface surrounding this access point occurred to approximately 2 feet in height to distances approximately 30 feet away from the access point. The USEPA submitted a letter dated April 8, 2011, describing observed soil displacement in this area of the Site. The Respondents and their Contractor prepared a response, dated April 15, 2011, which described the methods to manage all issues related to soil displacement presented by the USEPA in the April 8, 2011 correspondence.

As discussed above in Section 4.5 - Stabilization of Low-Lying Areas, in a memorandum dated May 2, 2011, USA presented a path forward to create a suitable bearing surface in the Western Cell, which would allow the necessary equipment to access and prepare the area to receive the LLDPE liner and armor rock cover. This memorandum delineated nine sections, whose individual areas were approximately 5,600 square feet. The sections were constructed by establishing water control berms to separate the individual sections and sequence the stabilization effort. Those sections located in the southern portion of the Western Cell were stabilized first and the stabilization proceeded to the north. A drawing is provided in the memorandum (Appendix H) that displays the section arrangement.

The memorandum also outlines the results of the bench scale tests and recommended that an 8 percent by weight mixture of Portland cement be used to stabilize the Western Cell. Additionally, USA identified the cement delivery requirement and the equipment necessary to complete the stabilization. In order to achieve a minimum 7 percent by weight mixture, Portland cement deliveries of 22 tons for every half section (2,800 square feet) were recommended. The memorandum specified that two long stick tracked excavators be operated from the central highland areas, and that during operations the excavator buckets would be qualitatively monitored to ensure that the penetration depth did not exceed the established thickness of 3 feet.

As discussed above, working on the soft materials at the Site required special construction approaches. Low pressure equipment, mats, and ground improvements will be required for any subsequent work on the nearshore and upland soils above the water surface.

11.4 Geotextile Deployment

The installation of the geotextile in the Eastern Cell is outlined in Section 5.3 – Geotextile Placement. The original geotextile placement method deployed the entire 300 foot length of a geotextile panel using cylindrical concrete anchors to weigh the geotextile down onto the sediment surface. The crew learned that the concrete anchors were insufficient by themselves to consistently hold the geotextile in place with the River flow rates encountered in the Eastern Cell. Therefore, the placement method was adjusted from fully installing a single geotextile panel prior to rock placement, to deploying the geotextile directly ahead of the armor rock placement. The geotextile barge was placed alongside the rock placement barge and moved from bow to stern manually using crew members and a jon boat. Crew members would deploy approximately 10 to 15 feet of geotextile, and the excavator operator would immediately place rock onto the deployed geotextile to provide adequate weight to hold the geotextile in place.

Future projects requiring the deployment of a geotextile in a river should consider several methods for deploying the geotextile, including the use of anchor weights, minimizing the amount of geotextile deployed at one time, and near-simultaneous deployment of the geotextile and armored cap materials. Some or all of these methods may be necessary to deploy geotextile in a river environment.

11.5 Turbidity Curtain Issues

As described in Section 5.1.4, once installed, the turbidity curtain became subject to the River currents and tidal fluctuations at the Site. The turbidity curtain frequently shifted position around the Eastern Cell with the incoming and outgoing tides; this movement was most pronounced near the I-10 Bridge where River velocities associated with tidal fluctuations were likely highest. The strain on the turbidity curtain resulted in separate instances where: (1) the turbidity curtain was detached from the anchors, resulting in a breach in the turbidity curtain that postponed rock placement operations for half a day until the breach could be repaired and (2) a portion of the floating boom was torn away from the submerged fabric skirt.

Shirley & Sons performed repairs, as needed, to maintain the integrity of the turbidity curtain system and keep the curtain held in position outside the armored cap placement area. As needed, additional 400 pound anchors were used to secure its alignment around the Eastern Cell. Additionally, for the duration of the TCRA the Shirley & Sons crew managed the position of the turbidity curtain using work boats and water-based construction equipment.

The use of turbidity curtains in river or tidal environments is difficult. In some situations, currents around the curtains can cause more resuspension of sediments than if the curtain were not there. Future projects in a river environment should consider alternatives to use of a turbidity curtain. These alternatives include combinations of dredging or capping BMPs coupled with tiered monitoring to judge the success of the BMPs.

11.6 Armored Cap Bathymetry

As described in Section 8.1.1 – Pre-Final Survey, the data produced by the bathymetric survey in the Eastern Cell and Northwestern Area proved inconclusive, with elevations up to several feet higher or lower than the pre-construction bathymetric survey. Because the bathymetric survey data was inconclusive, a manual probing survey was initiated to measure the thickness of the armored cap. Future projects may be well-served by including manual probing as part of the monitoring program.

Reasons why the bathymetric survey proved inconclusive are not clear. The pre-construction survey was completed by a surveying company that used tracklines spaced 50 feet apart and oriented radially around the impoundments. The progress and pre-final surveys were completed by two different surveying companies, and both of these surveys were completed using tracklines spaced 25 feet apart and oriented north/south/east/west. These differences in survey methodology (trackline spacing and orientation) may have contributed to the inability to correlate the pre-construction survey to the pre-final survey.

In addition, the completed armored cap was characterized by an angular rock surface. The angular rock may scatter the single-beam, dual-frequency bathymetric signal, which may cause difficulty in obtaining repeatable results between bathymetric surveys. The shallow nature of the rock, as well as the slope, can also complicate bathymetric surveys.

Future projects that utilize bathymetric surveys to evaluate cap thickness in areas with complicating factors should consider additional methods to confirm thickness. Complicating factors can include shallow water, steep sloping ground, and/or angular cap surface. Recommended means to increase the confidence of cap thickness determinations include:

- Use similar survey line spacing and frequency between the pre- and post-placement surveys.
- Complete progress surveys early on to confirm the suitability of bathymetric surveys as a tool (use the tool soon after the initial placement of armored cap materials to see if it will work).
- Ensure accurate monitoring of cap material quantities and coverage areas on a daily basis. This includes real time surveys on coverage areas and accurate quantification of materials placed.
- Use probing through the cap to confirm or calibrate bathymetric results.

11.7 Riverine Work Area Challenges

Tidal set and drift affected both the land- and water-based construction activities at the Site. High tides resulting from south winds submerged the access point described in Section 4.9.1 – Eastern Cell and inundated the low-lying portions of the Western Cell prior to surface grading and stabilization. As a result, work in these areas was suspended until the water receded. Tides on the other end of the spectrum (i.e., low tide conditions) also imposed conditions that were prohibitive to water-based construction activities. While installing the Eastern Cell armor rock, low tide levels prevented the material transport barge from accessing the barge-based excavator on several occasions. To account for the low tide levels the transport barge was light-loaded at the LaBarge dock facility; however, this strategy was not always effective.

Additionally, as mentioned in Sections 5.1.4 and 11.5, continuous maintenance of the turbidity curtain is required in this environment. The tidal set and drift in the River encouraged the migration of the turbidity curtain system from the original alignment along the exterior of the Eastern Cell. Shirley & Sons moved the curtain, as necessary, throughout the duration of the TCRA to allow adequate room for water-based construction activities.

Future projects located in tidal or river environments need to plan accordingly for significant changes in water depth. If a portion of the work is dependent on water depth, there needs to be additional flexibility in the construction schedule to allow for potential weather or tidal based delays.

12 TCRA CONTACT INFORMATION

Contact information provided below in Table 12-1 is for those individuals representing the USEPA and Respondents during the TCRA.

Table 12-1

TCRA Contact Information

Name	Affiliation	Contact Information		
		Address	Phone/Fax	E-mail
Phil Slowiak	IPC IPC Representative	6400 Poplar Avenue Memphis, TN 38197-0001	P: 901-419-3845 F: 901-214-9550	philip.slowiak@ipaper.com
Andrew Shafer	MIMC MIMC Representative	9590 Clay Road Houston, TX 77080	P: 713-772-9100 EXT:109 F: 832-668-3188	dshafer@wm.com
Valmichael Leos	USEPA Project Coordinator	1445 Ross Avenue, Suite 1200 Dallas, TX 75202	P: 800-887-6063	leos.valmichael@epa.gov
Craig Carter	Dynamac USEPA On-Site Contractor	1202 Executive Drive West Richardson, TX 75081	P: 214-377-2001	ccarter@dynamac.com
David Keith	Anchor QEA Project Coordinator	614 Magnolia Avenue Ocean Springs, MS 39564	P: 228-818-9626 EXT:221 F: 228-818-9631	dkeith@anchorqea.com
Randy Brown	Anchor QEA CQAO	10707 Corporate Drive, Suite 230 Stafford, TX 77477	P: 281-565-1133 EXT:2	rbrown@anchorqea.com
John Laplante	Anchor QEA Project Engineer	720 Olive Way, Suite 1900 Seattle, WA 98101	P: 206-287-9130 EXT:323 F: 206-287-9131	jlaplante@anchorqea.com
John Verduin	Anchor QEA Design Engineer	720 Olive Way, Suite 1900 Seattle, WA 98101	P: 206-287-9130 EXT:305 F: 206-287-9131	jverduin@anchorqea.com

Name	Affiliation	Contact Information		
		Address	Phone/Fax	E-mail
Ed Fendley	USA Environment Project Director	10234 Lucore Street Houston, TX 77017	P: 713-425-6943 F: 713-425-6956	efendley@usaenviro.com
Cesar Garcia	USA Environment Project Manager	10234 Lucore Street Houston, TX 77017	P: 713-425-6911 F: 713-425-6956	cgarcia@usaenviro.com
Jesse Garcia	USA Environment Health & Safety	10234 Lucore Street Houston, TX 77017	P: 281-513-5523 F: 713-425-6930	jgarcia@usaenviro.com
Ron Griffith	USA Environment Site Superintendent	10234 Lucore Street Houston, TX 77017	P: 713-213-6366 F: 713-425-6956	rgriffith@usaenviro.com

13 CERTIFICATION REQUIREMENTS

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of the report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John Verduin, P.E.	Randy R. Brown
Anchor QEA, LLC	Anchor QEA, LLC
Design Engineer	Construction Quality Control Officer

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TABLES

Table 10-1
TCRA Construction Costs

Item No.	Description	Quantity	Unit	Unit Price	Amount
Perimeter Fencing					
PF-1	Phase I Fence Installation	1	LS	$ 173,542	$ 173,542
PF-2	Phase II Fence Installation	1	LS	$ 98,323	$ 98,323
PF-3	Surveying	1	LS	$ 8,734	$ 8,734
				Total Perimeter Fencing Costs	**$ 280,599**
Project Set Up					
1	Mobilization/Demobilization	1	LS	$ 235,100	$ 235,100
2	Health & Safety	1	LS	$ 52,595	$ 52,595
3	Quality Control	1	LS	$ 48,425	$ 48,425
4	Site Security	1	LS	$ 105,840	$ 105,840
5	Environmental Protection	1	LS	$ 95,000	$ 95,000
6	Survey Control	1	LS	$ 136,700	$ 136,700
7	Access Road Construction	1	LS	$ 198,500	$ 198,500
8	Big Star Property Improvements	0	LS	$ 45,600	$ -
9	Sign and Buoy Installation	1	LS	$ 25,360	$ 25,360
				Total Project Setup Costs	**$ 897,520**
Cap Construction					
10	Clearing and Grubbing	1	LS	$ 65,000	$ 65,000
11	Western Cell Shaping and Grading	6	DAY	$ 1,775	$ 10,650
12	Granular Fill	638	CY	$ 32.95	$ 21,008
13	Geotextile	79,000	SQ FT	$ 6.25	$ 493,750
14a	Armor Cap A Material	14,238	TON	$ 29.99	$ 426,995
14b	Armor Cap AInstallation	14,237	TON	$ 48.26	$ 687,057
15a	Armor Cap B/C Material	11,276	TON	$ 29.99	$ 338,176
15b	Armor Cap B/C Installation	11,276	TON	$ 28.76	$ 324,306
16a-1	Armor Cap C Material	11,042	TON	$ 21.96	$ 242,476
16a-2	Armor Cap C Delivery	11,042	TON	$ 28.04	$ 309,610
16b	Armor Cap C Installation	10,069	TON	$ 32.75	$ 329,770
17a-1	Armor Cap D Material	25,621	TON	$ 21.96	$ 562,636
17a-2	Armor Cap D Delivery	25,621	TON	$ 28.04	$ 718,411
17b	Armor Cap D Installation	23,896	TON	$ 57.35	$ 1,370,457
18a-1	Armor Cap D(24) Material	0	TON	$ 21.96	$ -
18a-2	Armor Cap D(24) Delivery	0	TON	$ 28.04	$ -
18b	Armor Cap D(24) Installation	0	TON	$ 47.05	$ -
19	Install LLDPE Liner	138,000	SQ FT	$ 1.06	$ 146,280
				Total Cap Construction Costs	**$ 6,046,583**
Change Orders					
CO-01a	Land Lease - Wayne Borries	9	MONTH	$ 3,850.00	$ 34,650
CO-01b	Land Lease - Wayne Borries	1	LS	$ 7,700.00	$ 7,700
CO-02a	Land/Dock Lease - LaBarge	6	MONTH	$ 33,000.00	$ 198,000
CO-02b	Land/Dock Lease - LaBarge	1	LS	$ 7,451.61	$ 7,452
CO-03	Additional Handling, Transportation, Storage - GCLI	31,649	TON	$ 3.30	$ 104,441
CO-04	Change contract from long-sleeve shirts to short-sleeve shirts	0	NA	$ -	$ -
CO-05	Withdrawn	0	NA	$ -	$ -
CO-06a	Construction of TxDOT Turnaround and Laydown Areas - Equip/Labor	5	DAY	$ 3,150	$ 15,750
CO-06b	Construction of TxDOT Turnaround and Laydown Areas - Geotextile	3,000	SQ YD	$ 2.21	$ 6,630
CO-06c	Construction of TxDOT Turnaround and Laydown Areas - CCRB	2,259	TON	$ 22.33	$ 50,438
CO-07a	Debris Removal Under I-10 Bridge - Equip/Labor	14	DAY	$ 3,100	$ 43,400
CO-07b	Debris Removal Under I-10 Bridge - T&D	30	EACH	$ 530	$ 15,900
CO-08a	Purchase Guardrail	2,000	FEET	$ 11.96	$ 23,920
CO-08b	Install Guardrail	2,000	FEET	$ 8.91	$ 17,820
CO-09a	Additional Push Time for Barges	1	LS	$ 99,000	$ 99,000
CO-09b	Additional Low Velocity Power Unit	5.5	MONTH	$ 8,800	$ 48,400
CO-10a	LaBarge Stockpile Management (Equipment)	5.5	MONTH	$ 13,200	$ 72,600
CO-10b	LaBarge Stockpile Management (Labor)	5.5	MONTH	$ 11,880	$ 65,340
CO-10c	Additional LaBarge Required Insurance	1	LS	$ 18,925	$ 18,925
CO-11	Overtime Premium for Saturday Work	6	DAY	$ 4,325	$ 25,950
CO-12a	Additional Water-Based Placement of Armor Cap A	4,048	TON	$ 19.49	$ 78,896
CO-12b	Additional Water-Based Placement of Armor Cap C	2,361	TON	$ 40.00	$ 94,446
CO-13a	Western Cell Low-Lying Area Stabilization	5,373	CY	$ 34.29	$ 184,237
CO-13b	Leveling Fill Layer Placement	3,662	TON	$ 38.00	$ 139,171
CO-14	Project Warning Signs	15	EACH	$ 1,231	$ 18,466
CO-15a	Additional Transport Cost to Deliver Armor Cap C & D to Bluebonnet	2,696	TON	$ 13.80	$ 37,209
CO-15b	Additional Transport Cost to Deliver Armor Cap D to the Site	2,317	TON	$ 9.21	$ 21,341
CO-16	Transportation and Disposal of I-10 Debris to Coastal Plains RDF	25	EACH	$ 275.00	$ 6,875
CO-17	Armor Cap A Rock Associated with Access Point in Eastern Cell	2,005	TON	$ 29.99	$ 60,130
CO-18	Water-Based Rock Placement Standby during Cap Probing Survey	1	LS	$ 57,500.00	$ 57,500
				Total Change Order Costs	**$ 1,554,586**
Direct Construction Costs Total					**$ 8,779,289**

Note:
The construction costs listed in this table are subject to change pending final approval of all contractor invoices.

FIGURES

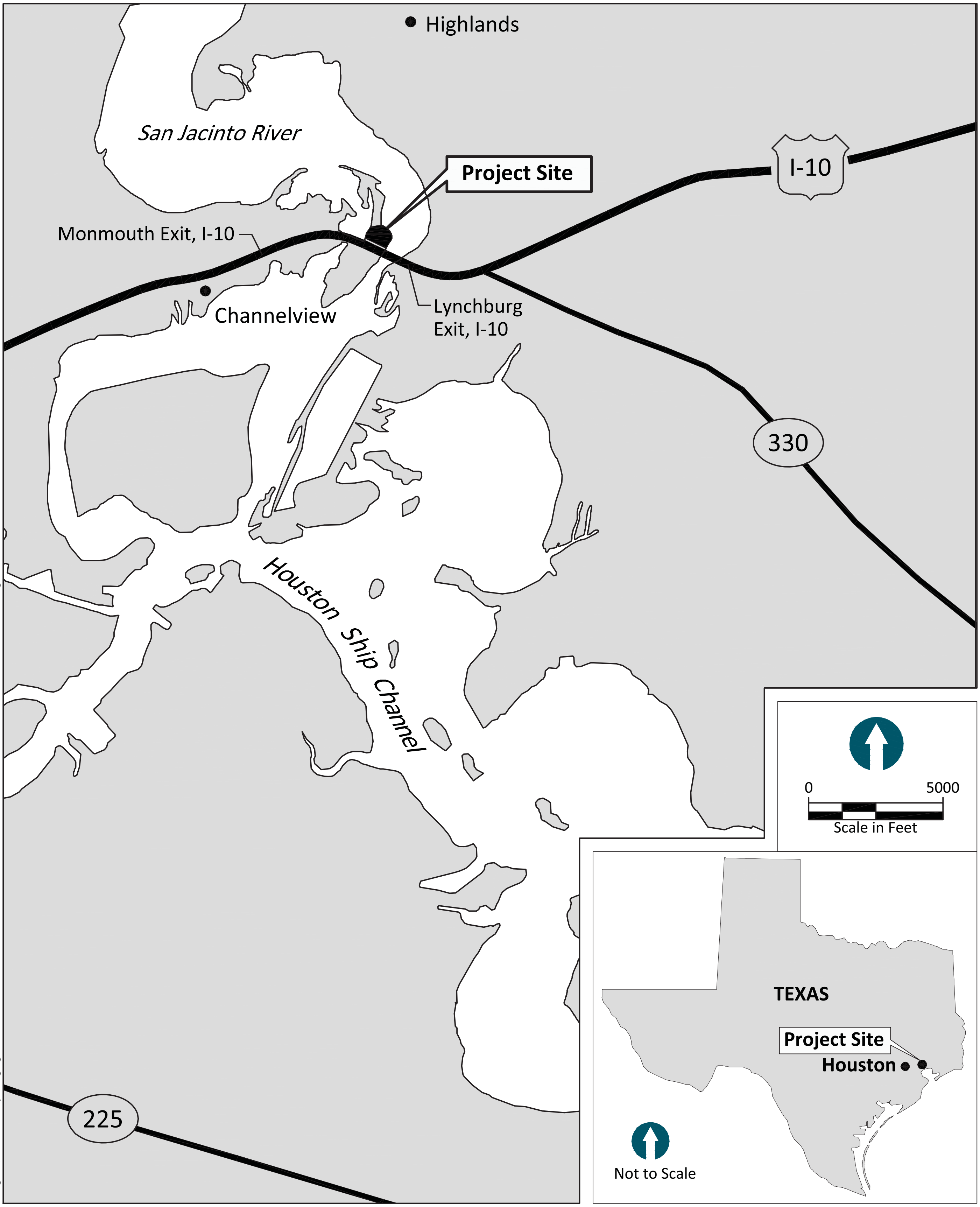

Figure 1-1
Vicinity Map
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

ANCHOR QEA

DRAFT

SOURCE: Google Map Pro 2009

Figure 1-2
Site Features
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

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Aug 12, 2011 4:27pm tgriga

LEGEND:

TCRA Sediment 2,3,7,8-TCDD Dry Weight and OC Normalized (ng/kg)

Original (1966) Perimeter of the Impoundments

SOURCE: Aerial Imagery: 0:5-meter January 2009 DOQQ - Texas Strategic Mapping Program (StraMap), TNIS

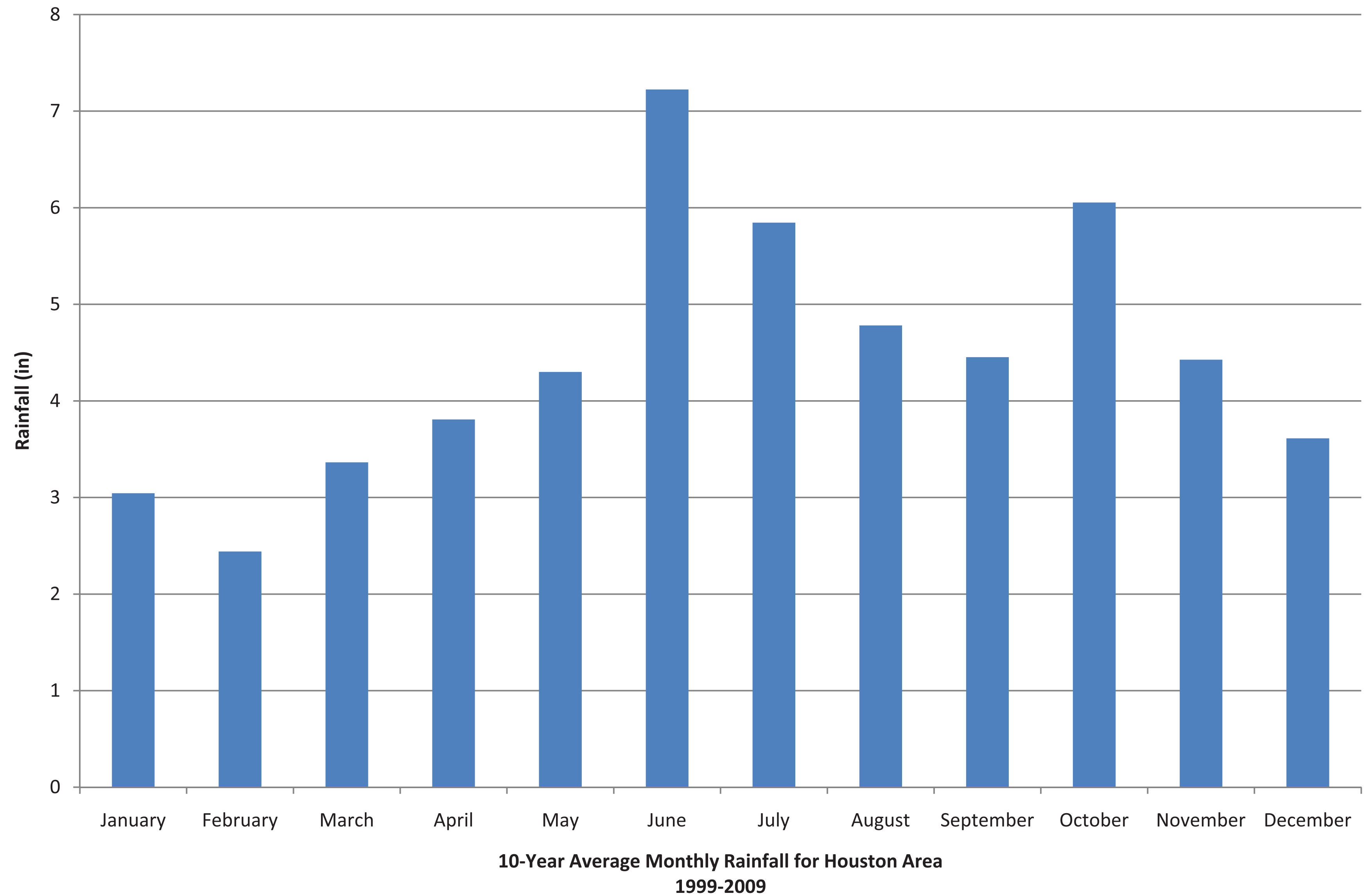
0 150

Scale in Feet

ANCHOR QEA

DRAFT

Figure 1-3
2,3,7,8-TCDD Sample Locations
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site



Source: Anchor QEA and Integral 2010

ANCHOR QEA

DRAFT

Figure 1-4
10-Year Average Monthly Rainfall for Houston Area
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

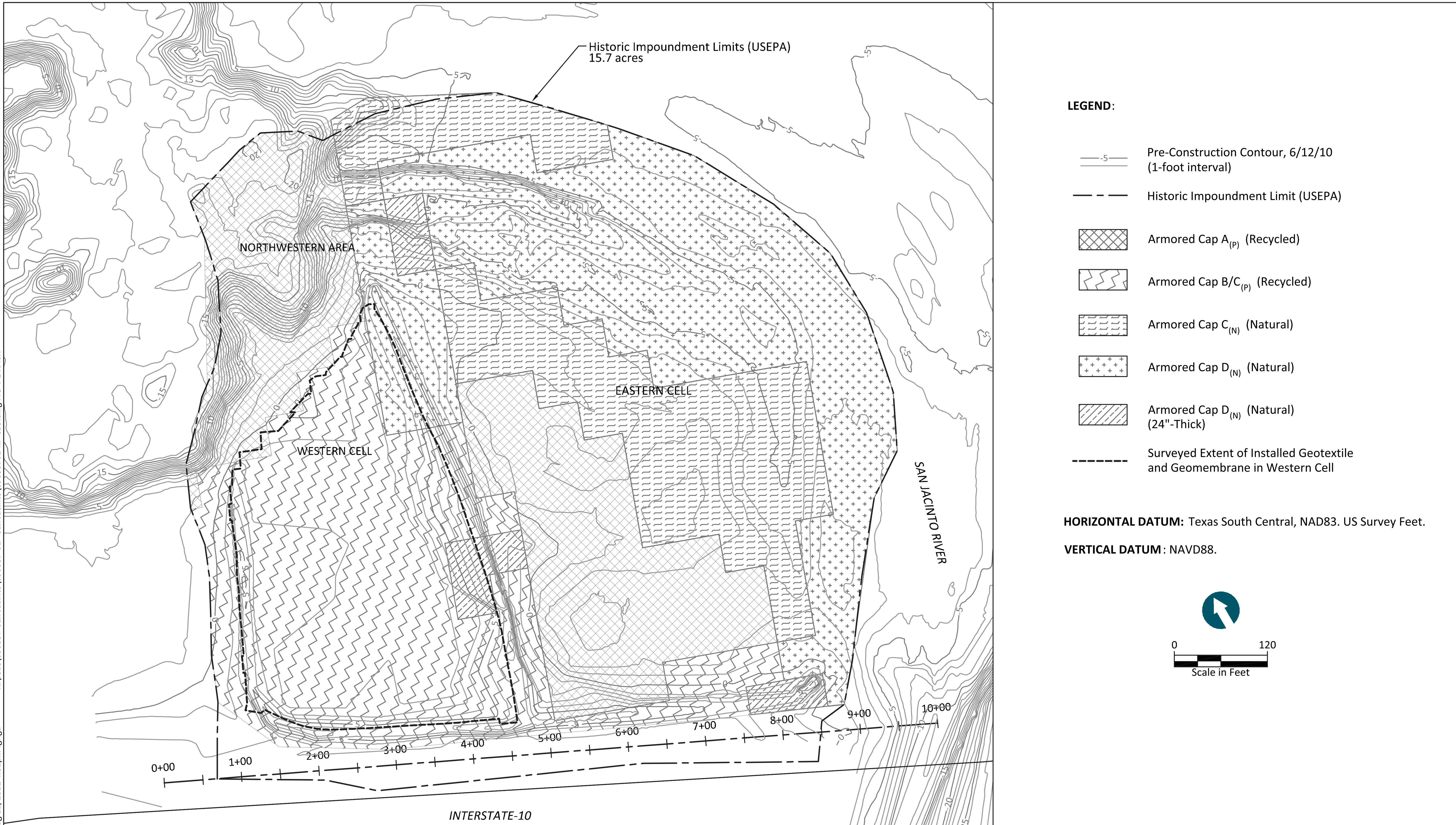
K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\09055701-RP-098.dwg Fig 2-1 RACR

Aug 15, 2011 10:14am tgriga

ANCHOR QEA

DRAFT

Figure 2-1
Access Road, Fence and Warning Sign Layout
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site



K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\0905701-RP-099.dwg FIG 4-1 RACR
Aug 12, 2011 4:31pm tgriga

Figure 4-1
Armored Cap As-Built
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

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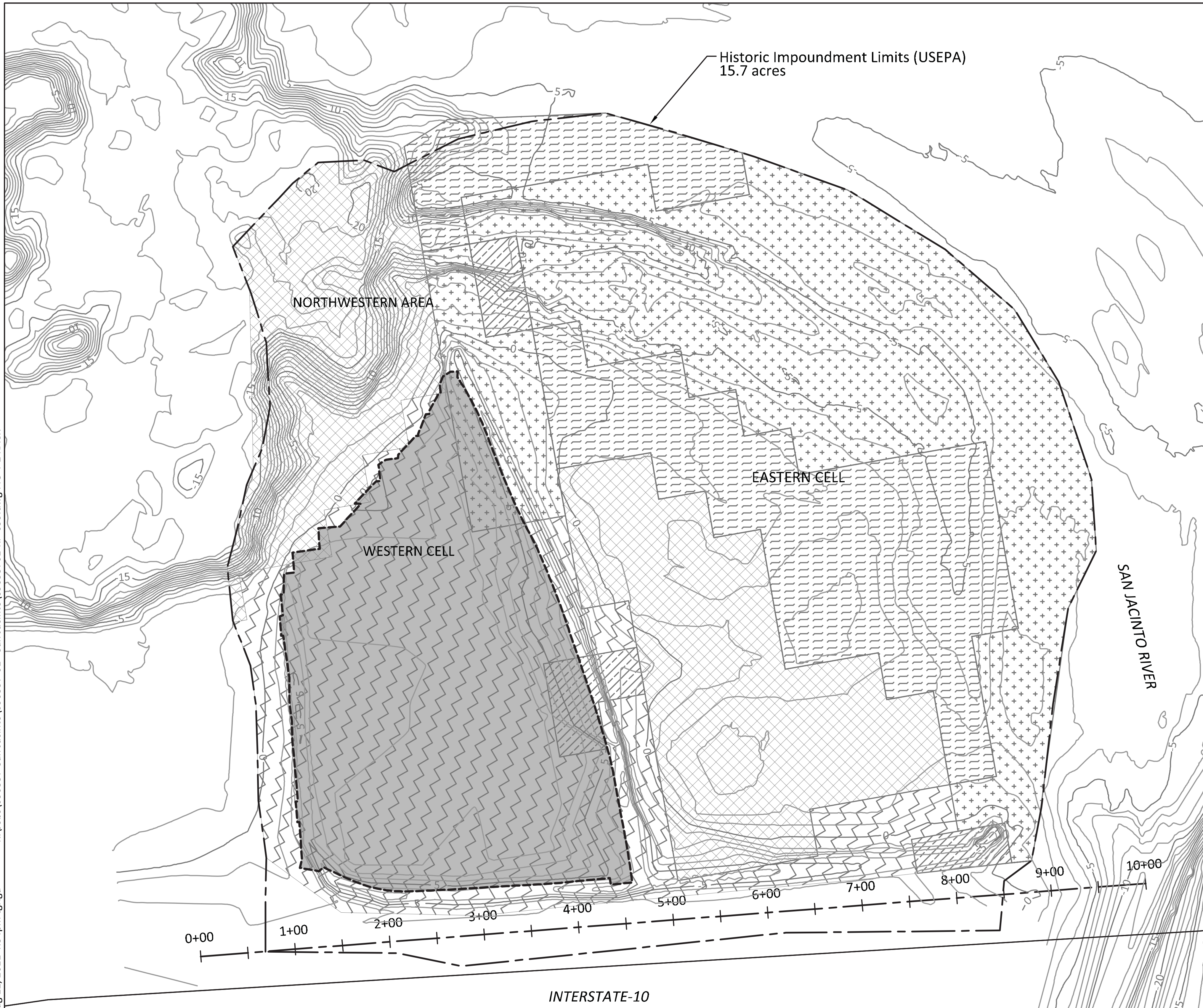

LEGEND:

- Pre-Construction Contour, 6/12/10 (1-foot interval)
- Historic Impoundment Limit (USEPA)
- Armored Cap $A_{(P)}$ (Recycled)
- Armored Cap $B/C_{(P)}$ (Recycled)
- Armored Cap $C_{(N)}$ (Natural)
- Armored Cap $D_{(N)}$ (Natural)
- Armored Cap $D_{(N)}$ (Natural) (24"-Thick)
- Surveyed Extent of Installed Geotextile and Geomembrane in Western Cell

HORIZONTAL DATUM: Texas South Central, NAD83. US Survey Feet.

VERTICAL DATUM: NAVD88.

NOTE:

1. The shaded area indicates the area where a 12-oz geotextile, 40-mil LLDPE liner, and 16-oz geotextile were installed in the Western Cell.

0 120
Scale in Feet

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\0905701-RP-099.dwg FIG 4-2 RACR
Aug 12, 2011 4:34pm tgriga

Figure 4-2
Western Cell Geotextile and Geomembrane As-Built
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

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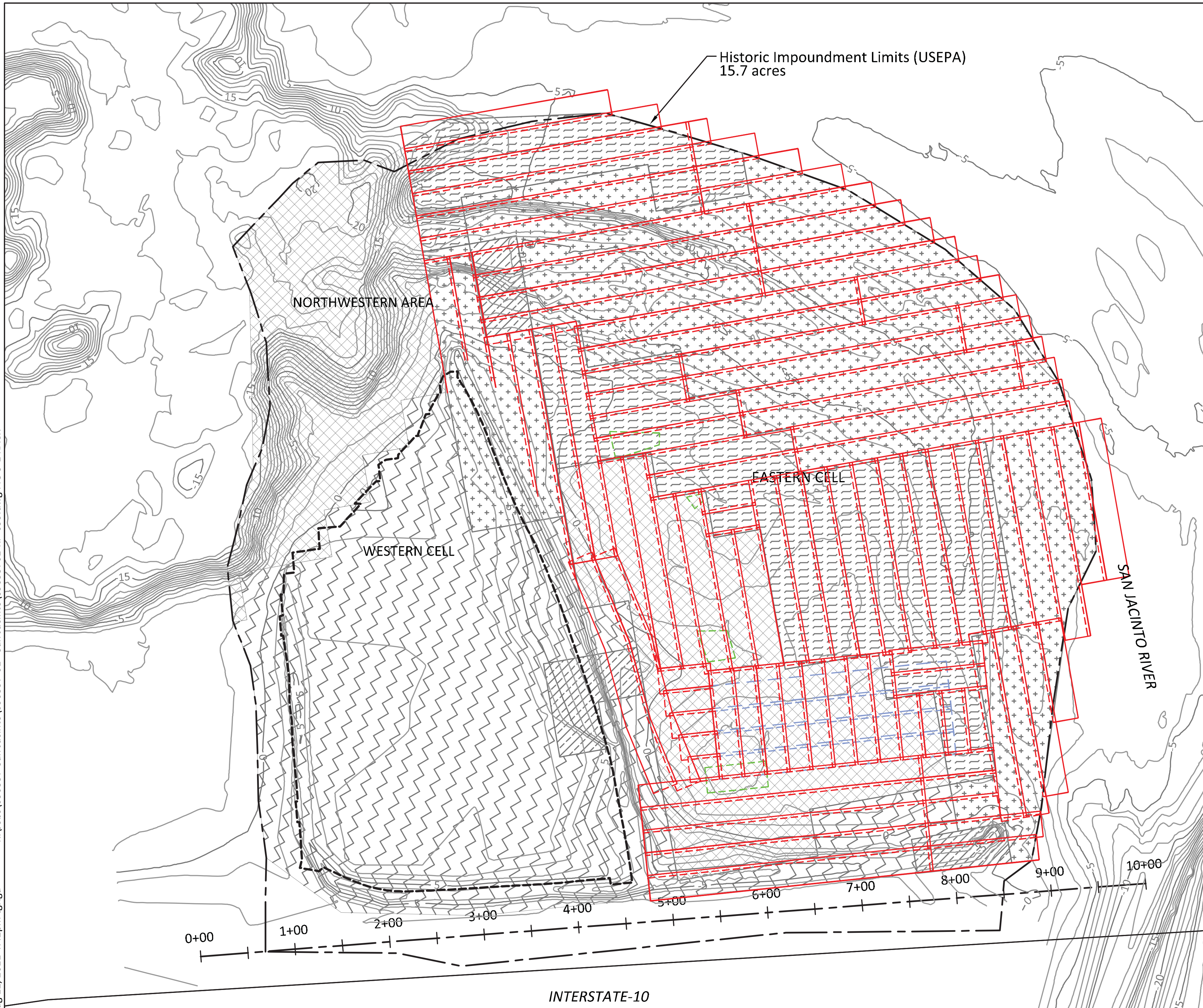

LEGEND:

Pre-Construction Contour, 6/12/10 (1-foot interval)

Historic Impoundment Limit (USEPA)

Armored Cap $A_{(P)}$ (Recycled)

Armored Cap $B/C_{(P)}$ (Recycled)

Armored Cap $C_{(N)}$ (Natural)

Armored Cap $D_{(N)}$ (Natural)

Armored Cap $D_{(N)}$ (Natural) (24"-Thick)

Final Geotextile Panels

USA Installed Geotextile Panels (Underlay)

USA Installed Geotextile Panels (Repair to Address Exposed Sediment)

Surveyed Extent of Installed Geotextile and Geomembrane in Western Cell

HORIZONTAL DATUM: Texas South Central, NAD83. US Survey Feet.

VERTICAL DATUM: NAVD88.

NOTES:

1. Panel data from Sheet M8, titled Panel Configuration, by CRA, Inc. dated May 20, 2011.
2. The fabric panels depicted by this plat are based on information provided by the client and is not the result of an actual survey performed by CRA, Inc. The fabric panels shown are 27' wide by 300' long (maximum) with a 3' overlap along seams.
3. The berm area data shown on this plat reflect various Site conditions at the time of survey and are added for reference purposes. Please refer to specific berm survey plats for additional information.

0 120
Scale in Feet

K:\Jobs\090557-San Jacinto\090557-01 - San Jacinto\0905701-RP-099.dwg FIG 5-1 RACR

Aug 12, 2011 4:42pm tgriga

ANCHOR QEA

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Figure 5-1
Water-Based Geotextile As-Built
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

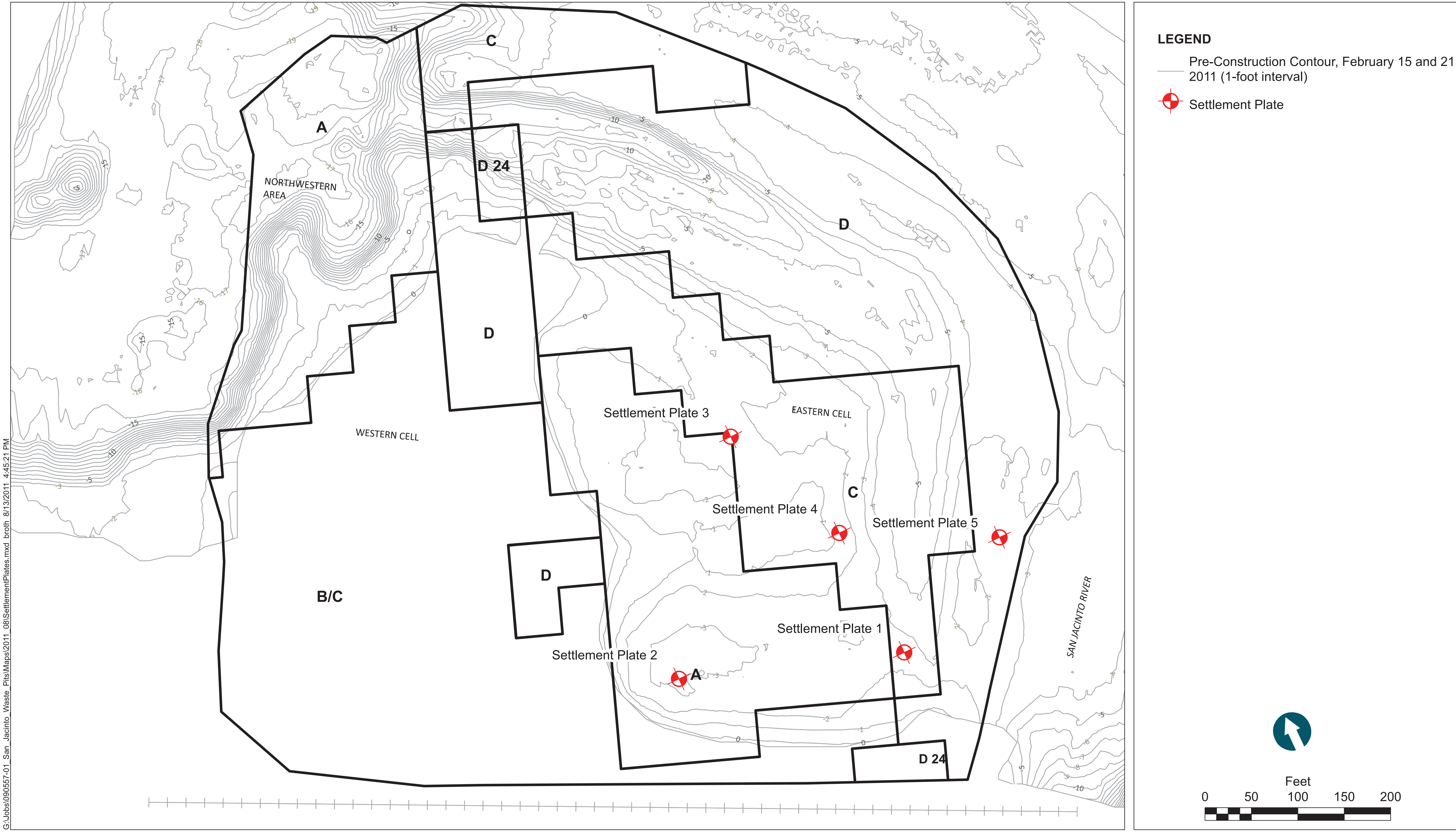

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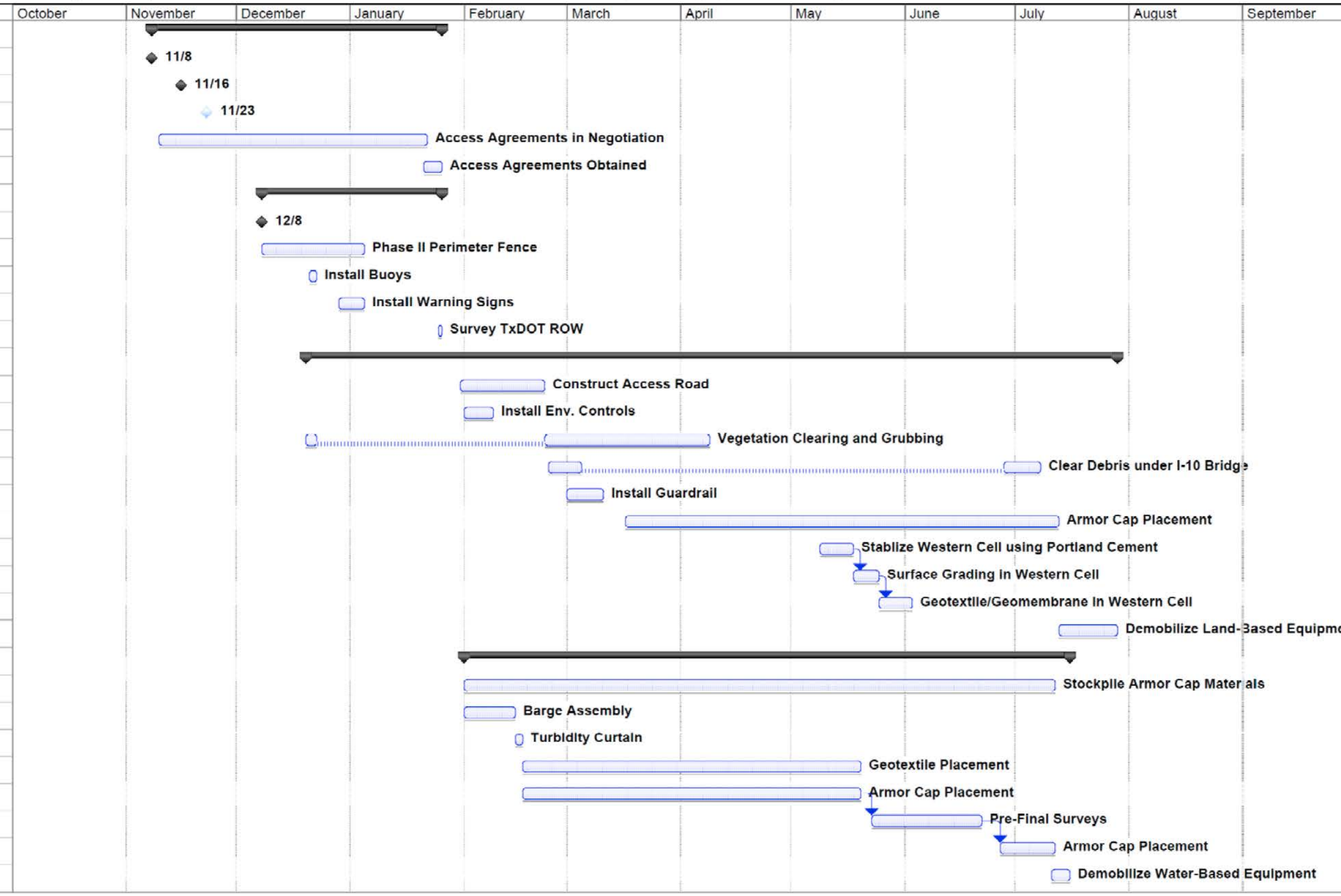
Figure 5-2
Settlement Plate Locations
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

San Jacinto TCRA
Chronology of Significant Construction Events

Not all construction-related activities are represented by the subtasks listed in this schedule. For more detail, please consult the daily and weekly reports included in Appendix C.

ID	Task Name
1	**Pre-Construction Coordination**
2	USEPA Approval of Final RAWP
3	Pre-Construction Meeting
4	Notice of Start of Construction Letter to USEPA
5	Secure Access Agreements (see Note 1)
6	Agreements Obtained for Administrative Area, LaBarge Property, and TxDOT ROW
7	**Mobilization and Site Preparation**
8	Start of TCRA Construction
9	Perimeter Fence Installation (Phase II)
10	Regulatory Buoy Installation
11	Warning Sign Installation
12	Survey TxDOT ROW
13	**Land-Based Construction**
14	Access Road Construction
15	Install Environmental Controls
16	Vegetation Clearing and Grubbing
17	Clear Debris from Under I-10 Bridge
18	Install Guardrail
19	Armor Cap Placement
20	Stabilize Western Cell using Portland Cement
21	Surface Grading in Western Cell
22	Geotextile and Geomembrane Installation in Western Cell
23	Demobilization of Land-Based Materials and Equipment
24	**Water-Based Construction**
25	Receive and Stockpile Armor Cap Materials
26	Assembly of Barges and Related Equipment
27	Deploy Turbidity Curtain
28	Geotextile Placement
29	Armor Cap Placement - Initial Pass
30	Pre-Final Bathymetric and Manual Probing Surveys
31	Armor Cap Placement - Final Pass
32	Demobilization of Water-Based Materials and Equipment



Project: San Jacinto TCRA
Date: Thu 9/1/11

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Figure 6-1_TCRA Chronology_2011-09-01.mpp
Rev_1

Note 1. Efforts to obtain access agreements began in January 2010. The timeframe for this task in this figure includes only the portion of time devoted to obtaining acess agreements following USEPA approval of the Final RAWP.

Thu 9/1/11
Page 1 of 1

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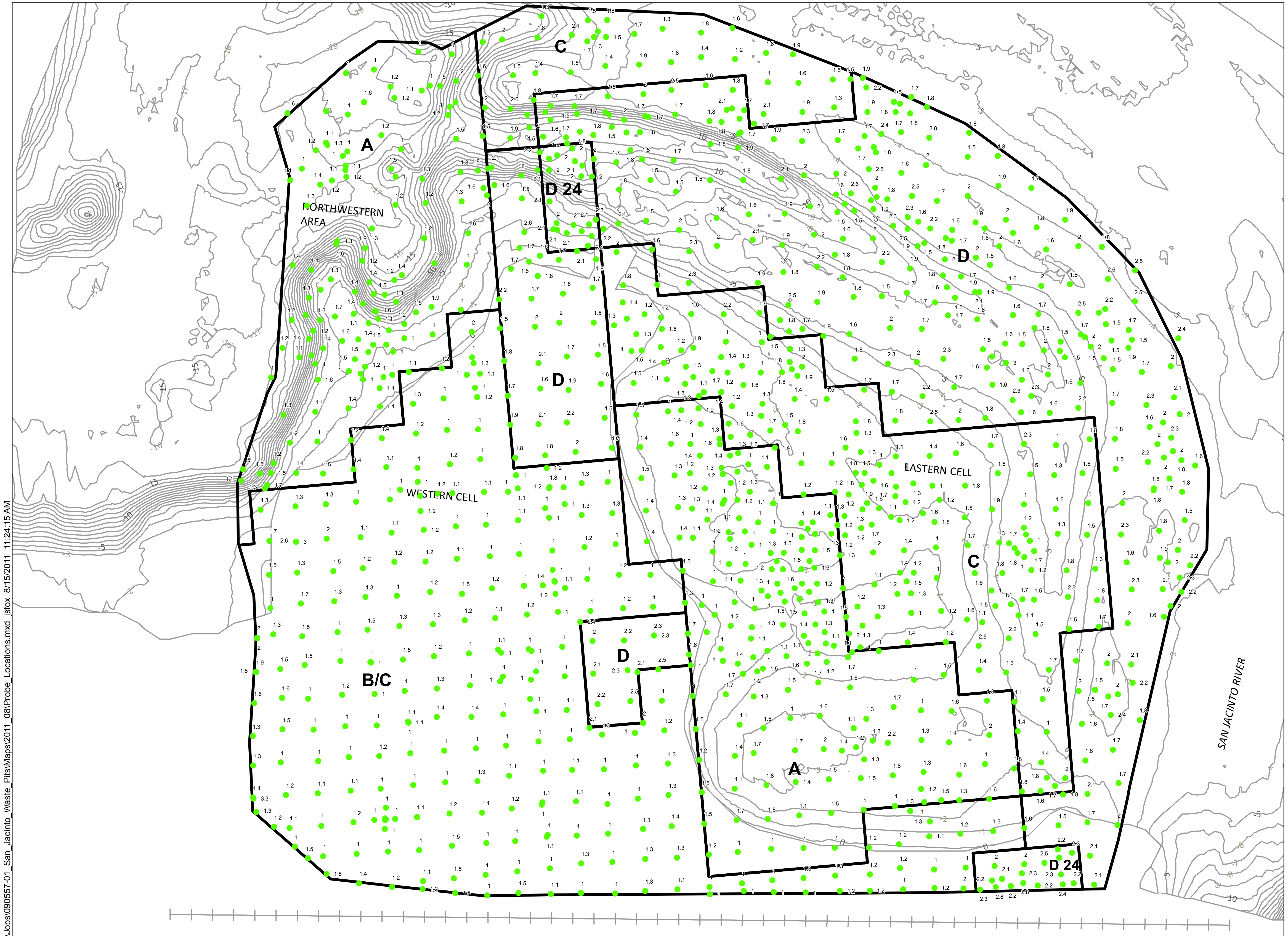

LEGEND

- Probing Location and Thickness; Meets or Exceeds Minimum
- Pre-Construction Contour, February 15 and 21, 2011 (1-foot interval)

Minimum Armor Thickness in Feet:

Area A	1
Area B/C	1
Area C	1
Area D	1.5
Area D24	2

Feet

0 50 100 150 200

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ANCHOR QEA

DRAFT

Figure 8-1
Manual Probing Final Survey
Removal Action Completion Report
San Jacinto River Waste Pits Superfund Site

List of Appendices – Provided on Attached DVD

Appendix A	USEPA Action Memorandum
Appendix B	TxDOT License Agreement
Appendix C	TCRA Daily and Weekly Progress Reports
Appendix D	TCRA Progress Photographs
Appendix E	USA Environment Requests for Information (RFIs)
Appendix F	Above-Ground Vegetation Memorandum
Appendix G	Western Cell Revised Approach Memorandum
Appendix H	Geomembrane Layout
Appendix I	LaBarge Property Pre-Construction Sampling Results
Appendix J	Water Quality Monitoring Memorandum
Appendix K	Non-Hazardous Waste Manifests
Appendix L	Material and Analytical Testing Reports
Appendix M	Operations, Monitoring, and Maintenance Plan